JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOLUME 36 APRIL 15, 1946 No. 4

National Responsibility for Research.[1]

J. E. GRAF, Smithsonian Institution.

If any common ground for international thinking has emerged from the wide conflict just ended it is that the world is looking forward to a higher level of well-being for all. Leaders both in Britain and in this country have given expression to such intentions, and the hopes of most peoples are in complete agreement. As we survey the colossal destruction of the war in human, scientific, cultural, and material resources, it is clear that the attainment of these hopes is a major challenge to the human race.

Science received world-wide recognition during and in the period following the first world war. King Albert of the Belgians advanced science on a national basis by subsidizing research laboratories in universities. Industrial research grew rapidly. Even the man in the street became aware of the importance of science and invention, for articles on important scientific and technological advances appeared in the daily press. This development was stimulated by the appointment of science writers by several metropolitan newspapers. The intelligent and fair approach of these writers to their subject did much to bridge the gulf which had hitherto separated the scientific from the nonscientific.

In 1938 there was published by the National Resources Planning Board under the title *Research, a natural resource*, a thorough study of the relation of the Federal Government to research in the United States. In pointing out that research is a national resource, it directed attention to the obvious need for the development of that resource. In this admirable study an analysis was made of the amounts expended by agencies of the Federal Government and of the various fields covered. It included as well a discussion of restrictions on the use of federal funds for research, including suggestions for improvement, many of which have since received favorable mention both in England and in the Bush report in this country. The section on research in American universities and colleges pointed out the great use of these organizations in training research men and in conducting basic research, a field in which universities excel, for they are largely free from the responsibility for solving specific problems. The summary of findings and recommendations presented many suggestions which recent studies have shown to be essential to the increase of research both nationally and internationally.

The popularization of science was well under way at the time of the second world war. General public interest in science was advanced further by the Germans in their oft-repeated mention of secret weapons. During their impressive early successes, these threats reached every ear—as indeed they were planned to do. The growth of allied superiority in the development of new devices both for offense and defense was given equal publicity. A parade of new and improved weapons, culminating in the proximity fuse and the atomic bomb, left with the general public the fixed idea that success in warfare was dependent more on skilled scientists than on the millions of bayonets once boasted by a late dictator.

While the war was still in progress and the outcome by no means certain, the role of science in the postwar world was the subject of active discussion in Britain. This was a logical trend, for Britain is no stranger to state-supported science. In the several councils for agricultural, medical, and in-

[1] Address of the Retiring President of the Washington Academy of Sciences, delivered before the Academy on the evening of February 21, 1946. Received February 25, 1946.

dustrial research, in various governmental research laboratories, and in grants to universities for facilitating fundamental research, there exists a broad base for state-supported science. Beyond this, there was a steady drift toward the full utilization of science in the war effort, an urge that came from scientists and government alike. Late in 1941 a meeting of prominent scientists and representatives of the war science committees was called by officers of the Royal Society. The principal subjects for discussion were postwar problems, including those of the immediate postwar period as well as those relating to the welfare of the peoples of the Empire. Even in these preliminary discussions it was stressed that while a little coordination may be necessary to guide research into profitable paths and guard against useless duplication, science must be kept free from close supervision which could develop into regimentation.

This trend toward planning for postwar research continued in succeeding years. There were people who still insisted that the development of science should be left to individual initiative, but they were fighting a losing battle against those who said that science should be centrally organized and that research in many fields must be expanded by government action. The phenomenal success of science in warfare, which by this time was turning the tide of battle, was quoted as a sign that freedom from want could be insured only through a full utilization of science. It was pointed out that this greater, state-supported research could be directed by committees representing government, scientific societies, and research departments. The development of both pure and applied science as rapidly as possible was recommended—pure science because it is the source of ultimate technological advance, applied science because it translates the advances of pure science into security and public welfare. As pointed out in statements from Nuffield College, however, the distinction between pure and applied science can be overstressed, since both methods can be, and often are, used simultaneously in solving problems.

There were also differences of opinion regarding the relations of science to politics. While the decline of German science since the ascendancy of the Nazi party in 1933 was presented as proof that science can not under all conditions remain free of the effects of political change, Sir Henry Dale was a powerful spokesman for those who wished to keep science free of politics. "I see danger," he said, "if the name of science or the very cause of its freedom should become involved as a battle cry in a campaign on behalf of any political system, whether its opponents would describe it as revolutionary or reactionary. If science were thus to be used as a weapon of political pressure, it would be impossible to protect science itself from the pressure of sectional politics." In general the fear that a state-supported science would become involved in politics, or would lose its freedom of action, has declined in Britain. A powerful organization of scientists, and the ability to present promptly all controversial opinions to a court consisting of an informed and unprejudiced public opinion, are weapons that would work against any action, whether by government or by pressure groups, calculated to limit the freedom of science or the research upon which it is founded. Throughout the discussion of an accelerated, state-supported research, there has been ample freedom for participation by all interested persons from government, industry, and the universities. Representatives of the association of scientific workers also took an important part in all discussions. And most important to an orderly consideration of the subject, in *Nature* there was a vehicle for prompt and impartial presentation of the various opinions.

A study of the extended discussion relating to the expansion of research leaves the clear impression that Britain will develop sound plans for a wide use of science in the future, directed both to national security and the welfare of the peoples of the Empire.

The situation as to the development of science in Russia is not so completely known. The general control of research is vested in the Academy of Sciences, which directs the efforts of thousands of research

men in all quarters of the Soviet Union. Through its close relations with the universities, the Academy also has the selection of the more promising science students. With the great expansion of universities and the much larger number of students enrolled in the science departments, the research personnel of the Soviet Union is increasing on an incredible scale, probably far ahead of any other nation. The Soviet Union has shown consistent good judgment in dealing with all phases of science. Research is a respected profession with a promising career for capable students. It is publicized widely in the daily press and scientists become national figures. During the war, Russia consistently maintained research on a high plane, and refused to sacrifice scientists on the war front. Construction of laboratories and research institutes has proceeded steadily so that at the present time research facilities in the U.S.S.R. are probably second to none, either as to number or equipment. Most important to the conservation of the time of research leaders, these laboratories are well staffed with assistants. At the same time field expeditions on a lavish scale have been continued, thus adding to a knowledge of natural resources. If there is a difference in science as practiced in Russia, it is probably that science there is more clearly directed to a purpose.

Further expansion of state-supported science poses no problem for Russia. The machinery for directing additional research now exists, and laboratories and universities with adequate staffs are available. Science will certainly continue to expand, for the leaders apparently realize that an adequate standard of living involves the use of science in the development of natural resources, in the growth of industry and commerce, and in further research in matters relating especially to health, food, and housing.

Elsewhere in Europe there are numerous signs that a centralized and expanded science will develop in the near future. Scientists met the most discouraging adversity in the war years with courage and devotion and kept alive a distinguished research tradition. With the record of those war years, it requires little imagination to anticipate a steady and strong growth, possibly even a great increase in research throughout Europe.

With science taking giant strides in other countries, the question might well be asked, "What of America?" There is need now to take stock of our place in world science, for isolation in science is even less possible than is political isolation. As we review our own place in science, there is room both for pride and humility. In the war we gave a crushing demonstration of the scientific and technological abilities and the industrial might of the United States. In accomplishing this miracle, however, we plundered our natural resources and we raided the ranks of our younger scientists. The net result is that we face a postwar world with depleted reserves both as to scientific personnel and natural resources. The dearth of trained scientists is doubly serious, since the shortage touches teachers as well as research workers. Of these the teacher shortage may be the most serious for until the universities and technical colleges are staffed effectively we can never hope to make up the present deficit in scientists. When we consider the planned increase in science in other countries, it is obvious that the elimination of our present deficit in research personnel is only a first step toward our goal.

Leading scientists are agreed that our country must embark on an enlarged program for scientific research and development. They further agree that to accomplish this object and insure the security of the nation and the welfare of its citizens, federally sponsored science is necessary. There is disagreement as to details touching the disciplines involved, to the types of institutions which should participate, and to the nature of the administration required. It seems certain that legislation dealing at least with some of the needs of research will be enacted.

The greatest source of danger to a plan for subsidized research is that the country as a whole does not truly appreciate the importance of this subject. With doubtful or wavering public support, a period of rigid economy might well cripple or completely stop such a program. This is a real danger,

for science has always been the first casualty in periods of retrenchment. The continuity of such a program can be assured only when the people of this country know that it is certain to win over a long period—even more, when they realize that without a strong, efficiently administered program of research, we, as a nation, shall be competing at a great disadvantage in a new world. We shall be competing at a disadvantage not only as to national security, and national welfare, but also in maintaining the world leadership we won in the period ending with the close of the war. Public support must be based on public appreciation of these facts, and only when this occurs will a program for increasing scientific investigation receive active and continuing support. The public should be treated with frankness; it should be informed that research is a gamble both as to the specific results obtained and the time involved. This is especially true in the case of basic research, the type most urgently in need of stimulation.

Is the world preparing to turn to competition in science, and what has happened to place science in the forefront of international affairs? Science and invention together had made an impressive record in the 40 years antedating the war. These developments touched the daily lives of millions. An enumeration of a few of the major industries will illustrate the great social implications of expanding science. In 1900 there were few telephones. The major growth of this huge utility falls within the forty years under consideration. Within this same period there came the automobile, airplane, motion pictures, rayon, and the radio. These inventions became the bases for giant industries, giving employment to millions, paying huge taxes, and providing conveniences that, while now commonplace, have had social influences too great to assess. Most of us knew of these achievements, but it took the greatest war in history to crystallize this knowledge into a full appreciation of science.

We shall consider science as related to national security only long enough to admit that we must have adequate research on weapons related both to offense and defense. To plan otherwise in our present confused world would be unthinkable. Preparedness, more than ever before, is the price of liberty. We may well remind ourselves that national security, for the long pull, should be based on something more lasting, and less exhausting, than more and bigger ships, planes, bombs, and guns. It would be well to be warned by the numerous examples in history that give weight to the words of Nietzsche, "Simply by being compelled to keep constantly on his guard, a man may grow so weak as to be unable any longer to defend himself." In planning means of avoiding future wars we must remember that in human contacts, whether on individual or national levels, fear is a poor substitute for understanding and reason.

Our principal consideration will be given to research aimed at improving the welfare of our people. This includes the types of research concerned with the development of the country's resources, its agriculture, industry, and commerce. As a nation can be only as strong as its individual citizens, the research program must be directed also toward the health of individuals, their food, shelter, and clothing. Since our goal is the accumulation of new knowledge on a wide front, all promising sources of information should be enlisted. It is not a small program, for its orderly development means the utilization of both basic and applied research in many disciplines, including not only those of interest and utility to man, but also those dealing with man himself and his relations to other men. It means the cooperation of institutions of many types, the universities to train scientists, and to conduct basic research; private institutions to undertake investigations in all categories and in all fields; Federal agencies to conduct both basic and applied research of wide scope; and finally, participation by the magnificent research services of American industry. The task ahead calls for the greatest wisdom that can be brought to bear upon it. It is a challenge to the government and to the scientist alike. There must be cooperation between agencies, for from these contacts there will arise the encouragement and inspiration so necessary to

creative achievement. Perhaps I should say cooperation and coordination; but since the latter term is susceptible of several definitions, especially as to degree, it should be used with care. A reasonable amount of coordination is required to make certain that the new program of research will become a useful and effective portion of the nation's total research. Care must be taken, however, to see that this program does not become a super science department with power over all national research. In the interest of good administration, the authority to direct and the responsibility for results must be bracketed together. Beyond this, there is required the application of a few general principles that have been demonstrated to be necessary to any efficient conduct of research. Science can not be regimented. At most it can be directed only along very broad lines, for who can declare in advance what is of great and what of little importance? It is obvious that specific direction could never have developed a Pasteur or a Kekulé. Their contributions to science arose from their own inquiring minds, from a great body of knowledge they had accumulated, and from disciplined imaginations. Under close supervision they would have been superior investigators, but they would probably be forgotten now. The degree of supervision and planning must be determined by a body of men who understand science and appreciate the difficulties of research, men who are capable of judging progress and the ability of individuals without looking over a worker's shoulder or, even worse, requiring multiple reports. Accomplishment has been observed over the centuries, and, while it is susceptible of broad variations, its recognition by experts does not require a lifetime. The selection of wise administrators of research, the determination of when and how to provide support, and how much to provide will always hold the key to success in any expansion of the research of the nation. Funds can be provided by law, projects can be assigned, but this alone can not assure maximum results, for organization can not do what only the genius of individuals can accomplish. The statement of Plato, that "under the influence either of poverty or of wealth, workmen and their work are equally liable to degenerate," is as true now as it was in his day. We must have understanding of science rather than science worship, and above all we must realize that science is a working tool, a means to an end. In stressing the use of research for social ends we are only restating the ideal of Benjamin Franklin, who made that objective a basic purpose of the American Philosophical Society.

The Federal Government is now engaged in research on many matters that concern both the individual and the nation as a whole. The development of national resources and their wise conservation constitute a field in which the government should lead and cooperate with all others engaged in similar research. This relates to forestry, geology, and agriculture in all phases, to mention a few of those close to national well-being.

Agriculture has always been closely related to human progress and still plays a dominant role in man's health, food, and clothing. With industry it will to a great extent determine his standard of living. Though plenty and peace may not be invariable companions, when the life of individuals is not a hopeless struggle for existence class strife within a nation and hostilities between nations certainly tend to disappear. A greater knowledge of agriculture will bring us nearer to this objective. There is still much to be learned about the land and its maintenance, about crops and the economics of farming. We must learn well and rapidly, for our new lands are shrinking. Our last large frontier is in the Arctic, and we are far from a knowledge of how to utilize it. In these basic matters that affect all citizens the government should be the leader and coordinator of research, with responsibility for its effectiveness and its extent.

The role of research in solving many of the problems of nations seems to be well established, and the welfare of a nation in this industrial age depends very largely on the continuing extension of the horizons of knowledge and the practical application of that added knowledge. The obvious question relates to how this may be brought

about in this country without incurring excessive expenditures and thus jeopardizing the success of the entire program. It seems clear that the project is of such scope and size that it must be administered and subsidized at the national level. The direction of such a complex program must be in the hands of experienced men who understand science and appreciate its social implications. Wide representation on such a group is necessary from all the agencies contributing in an important measure to the success of the program. This would include the Federal service, universities, private nonprofit research organizations, and industry. This group provided with advice from committees representing the various disciplines and with administrators as required would be fully capable of selecting broad fields for research, of selecting individuals or agencies to conduct research, and of determining the amount and nature of support required.

The types of national science foundations thus far suggested are of less importance than the abilities of the men appointed to the foundation. If the leaders are chosen for their qualifications, their distinction, and their ability and desire to serve, the administration is in safe hands. The tendency toward honorary or part-time appointment can be overdone. The program is too large, too complex, and much too important to be administered as an avocation.

It is not to be expected that such an organization could operate at full speed immediately for it must learn as it proceeds. It could, however, undertake several objectives with full knowledge that it is on the right track. One of these relates to providing additional research men, in part to make up the acute shortage which developed during the war, and partly to assure a supply of well-equipped men to carry forward the increased research this country must undertake.

One of the first steps to be taken in increasing trained research personnel is to eliminate much of the wastage of promising students who for financial reasons fall by the wayside before completing their academic training. The salvage of superior students from this group is an efficient and economical plan, for they have completed part of their training and their capabilities are already known. Scholarships should be awarded only to those who can profit from university training, and the leaders among the students should be educated just so far as this education is of use to them and to society. Those chosen to seek further knowledge should meet the high qualifications established by James B. Conant, "For the scholar, the seeker after truth, whether he be mathematician, archeologist, scientist, philosopher, poet, or theologian, must come into the court of public opinion not only with clean hands but with a consecrated heart. He must have integrity of purpose, a disciplined imagination, and the power of critical analysis of both the problem at hand and his own contributions. In addition, he must have high standards of performance as to the technical aspects of his task." In granting scholarships it would seem wise to examine present organizations experienced in this field to learn whether the existing machinery or methods for this purpose are capable of administering a larger government-sponsored scholarship program. It would be wasteful to ignore demonstrated accomplishment in this specialized field.

In training young scientists it must be borne in mind that quantity can never take the place of quality. New ideas, or new applications of old ideas, do not arise from oceans of minds. They come from a few superior minds in which inquiry, knowledge, and imagination are compounded in favorable proportions. Linnaeus long ago noted that encouragement should be given to clever students, "for the great discoverers are among them, as comets among the stars." The effectiveness of a training program depends almost entirely on the ability of the teachers, as has been so often demonstrated where a single preeminent professor has carried his department to first rank within the nation. If outstanding students are to be aided in obtaining the training necessary to speed research at full efficiency, it is equally important to relieve the outstanding teachers of the extraneous duties which reduce their use as teachers. It may even be said to be more important, for a single teacher may train and inspire many

discoverers. In any training program it is thus necessary to seek both students and teachers. Once these are brought together in an environment favorable to science, it will be demonstrated that huge numbers of investigators are not required to keep our country among the world leaders in science.

Under the scholarship program the nation will become deeply involved in educational matters, and it can not escape a direct interest in the quality of training facilities. During the war period, colleges and universities gave close study to their curricula with the idea of making improvements where changes were indicated. One change suggested was a broader base in training in the first college years. The report of the president of Pomona College to the alumni illustrates how one college has met the changing trend: "The new curriculum is dominated by the philosophy that in the first two years the student should acquire certain fundamental skills, appreciations, and bodies of knowledge." This is a definite change in the right direction and agrees closely with British statements on the subject. Broad training in fundamentals will provide the student with the confidence and the working tools so necessary to systematic solution of problems.

Another urgent field for expanding our educational facilities is the training of specialists in foreign areas. The need for this has been expressed very well in the constitution of the United Nations Educational, Scientific, and Cultural Organization: "Ignorance of each other's ways and lives has been a common cause, throughout the history of mankind, of that suspicion and mistrust between the peoples of the world through which their differences have all too often broken into war." The war showed us that area experts in the United States were almost nonexistent. Through the cooperation of the universities and colleges great strides were made to meet the need for such knowledge. Training in this field must be continued since the necessity for such experts will not be less with the coming of peace. We must learn more of other peoples and their problems, for whether we like it or not we are now neighbor to all peoples of the world.

Interdisciplinary training should also be stressed. A research man should have knowledge of several disciplines beyond the specific knowledge of the division or subdivision of his own field of science. With this added equipment he has a clearer understanding of his problems and possesses abilities to use these related disciplines for their solution. He is not only a better research man on his own, but with this wider appreciation of the utility of other disciplines he is more valuable as part of a research team. War research demonstrated that scientists often received their most useful assistance from coworkers, who brought to the solution of problems viewpoints and methods from widely different types of work.

The continuing success of the plan to stimulate research will depend to a large extent on the understanding and intelligence used in the administration of the program. Its first concern is to outline policy, to determine what funds are to be procured, and to learn how to obtain the maximum of results from the funds at hand. The latter consideration includes a decision as to the approximate proportion of the funds to be expended for security research and how and where it will be used. The remaining portion for welfare research must be further divided between scholarships and basic and applied research. As to agencies, it must be divided among university laboratories and classrooms, private, nonprofit research institutions, government research laboratories, whether Federal or state, and laboratories for the solution of industrial problems. The selection of laboratories and men, the terms under which funds will be available, and the approval of projects will all have much to do with the degree of success of the undertaking. Administration of the program will require the continuing study and advice of many scientists from all disciplines. Projects may or may not succeed, but they should have an honest chance by being placed in the friendly surroundings of skilled investigators and well-equipped laboratories. Beyond this each project should have a fair test as to time. Year to year allotments with no assurance against reduction or termination are not likely to attract the best minds. Utilization

of our leading scientists for stop-gap experimentation would be unfair both to the man and to the nation. No practice should be adopted as adequate until its soundness has been demonstrated. One example will suffice. We speak of basic and applied research as two separate fields, which must be kept distinct. Some believe that the basic research workers would be unable to apply their findings to practical use and that applied research workers would be of little use for fundamental research. This may hold for a small number of scientists, but a large number of men have shown by their work during the war that the same general qualities are required for superior research of either type. Basic and applied research are now used together by the London, Midland, & Scottish Railroad under a plan by which research men from the railroad and its cooperating universities are exchanged for temporary periods. From preliminary observations it seems that both basic and applied research will profit from this arrangement. It is a further step in breaking down the cell walls that have, in varying degrees, insulated one worker and one problem from another.

Those who will be responsible for the administration of public sponsored research must expect criticism, for they are using funds in which every one has vested rights. Public support is absolutely essential to the continuing success of an accelerated program; and this support to be lasting must be based on an understanding of the aims of the program and an appreciation of what science has done and can do again. There should be full publicity on all phases of the operation of the program. It must be necessary not only to be independent of the influence of pressure groups but also to be able to prove that independence. Though wartime science went from one triumph to another, it must be remembered that peacetime research will be measured by different criteria. During the war the cooperation of research men was a patriotic duty, and the cost of projects was entirely secondary to speed and to success in solving problems. In times of peace the cost of research programs will become a matter of major importance and one for annual discussion.

The results of research touching individual or national well-being should be given the widest distribution. This should be the standard method not only of diffusing useful knowledge but also of reporting progress. Used intelligently, it will make unnecessary the collection of multiple reports, questionnaires, form, and records, which at best accomplish little more than delay the work and drive out those investigators who prefer research to the piecemeal discussion of it. Publication of results should be prompt and full, and adequate distribution should be made nationally and internationally. This will serve not only to speed research but also to prevent needless duplication of effort.

Whether publication should be undertaken in more than one language is problematical. I should incline to advocate that each nation publish in its own language and leave to an international catalogue and abstracting service the task of furnishing abstracts and serving as a clearing house for providing translations in such languages as may be requested. This would be no great change from the International Catalogue of Scientific Literature, which after years of effective service to science suffered so grievously from the first world war that it never recovered. If the nations truly wish to cooperate, let them resurrect this useful service with such changes as the needs of the present day may require.

Although our discussion has been concerned largely with the national aspects of such a research program, there are many who will regard it as only one part of a larger problem. The real objective of this undertaking for the increased use of science depends largely on who happens to be explaining its purpose. To one, science may insure national security; to another, it may mean the economic welfare of the nation; while a third might look at the world and see international cooperation and understanding and enduring peace. Science utilized more widely can raise the standard of living in America, it can provide jobs, it can turn the wheels of industry and fill ships with exports. It can increase the comforts of individuals; and, as far as weapons may be concerned, it will certainly increase the

security of our nation. All this, however, is the answer to only a part of the question as it affects Americans. Our welfare over any long period is related to the welfare of other peoples, for now as never before poverty and misery in one part of the world affect the prosperity and well-being in all parts of the world. Thus our standard of living can not be completely and permanently independent of that of other peoples.

As a preliminary to improving the economic status of peoples, it is urgent to speed the work of recovery in all countries. This heavy task calls for international cooperation in all fields of science. Obviously those nations that have suffered the least must assume the leadership in this program of restoration. The question as to where this cooperation should start or what it should undertake is one of some magnitude. The most urgent need is in those countries that were overrun by the Axis, in which science was destroyed in part and scattered. The first step is to help each nation to help itself by organizing exchanges of current literature, abstracts, and translations as rapidly as possible and to bring victims of a scientific blackout up to date on recent world research. Restoration of the scientific literature in war-area libraries is a large task, but an early beginning should be made. Contacts between workers on similar problems should be established and assistance given, if only advisory, on research materials, equipment, and other facilities. International contacts and meetings concerned with science should be expedited and the exchange of students and teachers promoted. The preliminary operations in these fields are largely multilateral in nature and they should fall within the scope of international organizations. Of these the one covering the broadest field is the newly formed UNESCO; and there are others of lesser scope, some of which are ready for operation. It is too early to make promises as to the activities of UNESCO, for it is still in the preliminary stage of organization. Specific programs have been proposed covering such subjects as the social problems of housing, language teaching, and surveys for rehabilitation of the educational systems in devastated countries. It will undoubtedly serve on a world-wide basis to promote the free flow of information, both cultural and scientific, and to encourage the exchange of students, teachers, scientists, and artists. It will be a general source of information to facilitate giving to nations the educational, scientific, and cultural aids lost in the war. In undertaking these activities, however, the projected aid is on an advisory rather than on an active participating level.

The more active operating programs in international cooperation will include those on a bilateral basis. Such projects, arranged through the Committee for Scientific and Cultural Cooperation, are already in operation in many places in this hemisphere. Projects of this type, now active, include such diverse fields as agriculture, anthropology, geology, tidal studies, vital statistics, and meteorology. There is included also cultural cooperation in many fields of the humanities and the exchange of personnel, including scientists. These projects, which must be of value to both participants, are operated on the level of the people, and active participation by both countries is required. The objective of the program is to further understanding between the nations and peoples of this hemisphere, to advance their interests, and to maintain peace. That the plan is successful in advancing international relations has been demonstrated repeatedly. Authorization for the extension of this program to other parts of the globe is now before Congress. Cooperation in science on a world-wide scale, in improving economic conditions within nations, can contribute much toward removing a fertile and continuing cause of wars. We must remember that any discussion relating to the welfare of peoples can not avoid consideration of ways and means for preventing wars, which cause losses in human and material resources, beyond appraisal. The last war cost this country alone over a million casualties and 354 billions of dollars. These partial costs show clearly the futility of planning a comfortable standard of living, if wars, on the modern scale, are permitted to recur at intervals.

The question has been asked as to whether science is not given an undue por-

tion of the projected program and whether the well-being of peoples would not be advanced further by including the humanities. These have always been international in character and thus furnish a meeting ground on which races, creeds, and nations may find common appreciation and understanding. The humanities play an important part in the progress of mankind, and obviously the advancement of human welfare and peace must include the humanities in ever-increasing amounts. One answer to this question is that a program including the humanities is now operating under the guidance of our State Department and it will expand as it receives further support from the United Nations Organization and from other programs of international scope. It is a separate program and should remain so, both as to direction and support. Perhaps the principal answer to the question is that survival and recovery are the immediate needs, and science has demonstrated its ability to function in emergencies. Science is ready to go ahead now and it has world-wide support. In addition to meeting immediate needs, science can do much to sponsor international good-will for it too is truly international in character. Science has an important role in pointing the way to the recovery, well-being, and peace of the world; but it will make its greatest contribution to human welfare when it realizes the necessity for pooling its efforts with those from other sources of assistance. Thus, whether we consider our problem from the national or world-wide viewpoint, all science might well adopt the ideal to which Hugh Taylor, in speaking for the physical sciences, gave such eloquent expression: "In the free world to which we still dare to look forward, with the soldiers and statesmen, artists, humanists, philosophers and priests, we must integrate our scientific skills with the social and spiritual aspects of human life and nature. That goal attained, we shall not lack either direction or support."

ETHNOLOGY.—*An Iroquois Condolence Council for installing Cayuga chiefs in 1945.*[1]

WILLIAM N. FENTON, Bureau of American Ethnology.

Three of us white people stood shivering in the November afternoon on the common at Lower Cayuga Longhouse (Fig. 2). Robert and Marcelle Hatt had parked the Cranbrook Institute Buick alongside a row of Indian cars, and I had backed the Library of Congress Recording Laboratory sound truck abreast of the others and dismounted without locking the doors, remarking to Joe Williams, a Seneca from Allegheny, that my cameras would be safe since there were no other white people around. Inside the longhouse the Cayuga and Oneida chiefs were still rehearsing the Six Songs of Farewell to the Dead Chief.

Smoke of the cooking, intended for the chimney, drifted out the door of the cookhouse just east of the longhouse. One of the two male cooks for the new chiefs, Patterson Davis (C.),[2] ladled meat, chunks of boiled beef, out of a great iron cauldron into a wooden trencher. This was part of a quarter of beef that we had procured in Caledonia the day before of William Smith, butcher to the Six Nations. In olden times eight men were appointed to procure venison for the feast; they went out all abreast driving the game until eight deer fell. Nor was there any corn bread, hulled white corn soup being the only aboriginal dish. I re-

[1] A lecture on "The Six Nations of Canada" given before the Royal Canadian Institute, Toronto, January 12, 1946. Published by permission of the Secretary, Smithsonian Institution. Received February 7, 1946.

Field work for this paper derived support in 1941 and 1943 from the American Council of Learned Societies, in 1945 from the Viking Fund, Inc., Cranbrook Institute of Science, the Library of Congress, and the Smithsonian Institution. In the narration the writer has checked his own observations made on November 20, 1945, with the explanations of Deputy Chief Howard Skye, interpreter, which form the warp of the fabric, and into these he has woven speeches taken from a long Onondaga text describing the same ceremony which Chief John A. Gibson dictated to Dr. A. A. Goldenweiser in 1912 as the final fifth of a 525-page account of the founding of the League, that much having been translated from Onondaga to English by the late Simeon Gibson and the writer in 1943.

[2] C., Cayuga; M., Mohawk; Oe., Oneida; On., Onondaga; S., Seneca.

marked to Mrs. Silversmith who oversaw the preparations for the feast that women are customarily feast cooks at Tonawanda and Allegheny among the Senecas where men wait on the women, but she confirmed what we saw at Six Nations on Grand River—men usually do the heavy cooking for longhouse feasts. Evidently the Canadian Iroquois matrons hold their clansmen in firmer control than their Seneca sisters on the American side.

But both sexes fulfill the role of "hanging the kettles for the chief" (honwanajiahaá-nink ne' hoyaáneh). Each matron enlists a man and a woman. Mrs. Bomberry had two cooks: Patterson Davis, an official of the longhouse, and his half-brother Freeman ("Spike") Gibson, one of the two male leaders of Seneca Longhouse. Bob Bill, Howard Skye, and his sister Mrs. Silversmith served Jemima Gibson. All cooks, being Cayugas, belonged to the proper side.

A car lurched through the gate and chugged up the common. It disgorged a stout Cayuga chief, Hagya''trone' (Alex Nanticoke), and a younger deputy, S'oheés (Howard Skye). They were returning from Onondaga Longhouse, some two miles west, and they hustled inside to report. About noon the Three Brothers side (Mohawk-Onondaga-Seneca) had dispatched a scout (haihwakdon''na') to find out the state of preparations at the Four Brothers (Oneida-Cayuga-Tuscarora-Tutelo) fire. He went first to Lower Cayuga Longhouse, but finding no one there he returned partway to the matron's fire where the cooks were eating. Jemima Gibson who sponsored the ceremony and her maternal relatives and in-laws had set a dinner for the Cayuga chiefs and the cooks whom she had enlisted to work at the longhouse. The Onondaga runner, who drove a Ford, was told that the Four Brothers would send a messenger when ready. On returning to the longhouse from dinner, Desga'he' (Chief Alex General) arranged to send a runner to Onondaga. Howard Skye was appointed, and Hagya''-trone' drove him. Arriving at Onondaga Longhouse, the Cayuga messenger found the chiefs inside rehearsing the Requickening Address. They stopped on seeing the messenger who said, "I am bearing a message of the Four Brothers who sent me to say, 'Now preparations have been completed.' So that is the sum of my message."

With the return of the Cayuga messenger, everyone knew that the Three Brothers had taken up the path and would arrive momentarily. Warriors were detailed to kindle a small fire near the gate. They cleared away the leaves and dry weeds just east of the path leading from the road to the common, where a cook carried embers from the main fire. They build the wood's-edge fire as soon as they hear the singer chanting the Hai Hai on the path, recounting the Roll of the Founders of the League, while the procession of Condoling chiefs nears the fire of the grieving tribes.

About 3 o'clock "Keya'dawennn . . . (My nephews," the prolonged cry of the crier who marches beside the singer, floated over the elm and shagbark hickory trees to reach us before we heard the voice of the Hai Hai singer. The cry meant that the singer had just completed the roster of a committee of founders representing one of the Five Nations. The shout of the "uncles" quavered on the cold wind. I shivered, transported three centuries to the reedy shores of Cayuga Lake, wondering how that cry must have sounded coming over the forest from Onondaga near modern Syracuse. The clear voice of the *Haii Haii* next reached us. The singer was Roy Buck, a warrior in his thirties, whom the chiefs of Three Brothers side were grooming for this role at the rehearsals.

The procession passed Peter Atkins's at Six Nations Corners and neared the gate. In advance came Sam Silversmith (Oa.) and Bill Henry (M.) at the head of a double column. Next came the singer and the crier. Then walked Onondaga chiefs Gowena'-sen'donh (Peter Buck) and Tadodáaho' (Joseph Logan), followed by the rest of the chiefs; most of them carried canes, of which one was carved with ball and socket. The scouts also carried sticks. (Fig. 3.)

Anciently the two warriors, who guard the singer (denhunwadiya'dadún''), probably ranged far ahead as scouts. It was Howard Skye's opinion that in olden times, at the founding of the League, warriors of enemy nations lurked in the forest. Evi-

dently the order of march did not follow the roll call of nations—from Mohawk to Seneca—and it is not certain that this order was customary; at any rate there were two warriors, a singer and crier, the chiefs and deputies, such as were in attendance, in double column. One wonders that the systematic Iroquois had overlooked the chance to regiment the line of march.

WELCOME AT THE WOOD'S EDGE

The Oneida and Cayuga chiefs, their deputies, matrons, warriors, and the following public came down the common and

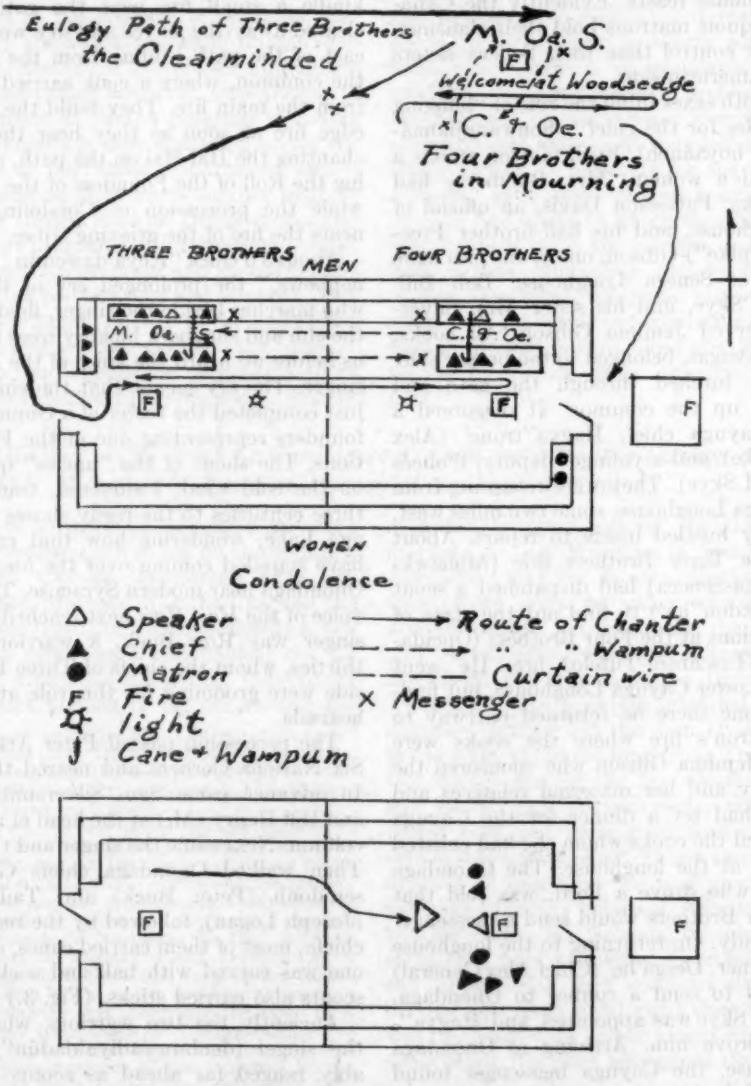


FIG. 1.—Diagram of the Condolence rite and the Charge to the new chiefs.

ranked themselves in this order facing the fire, the road, and the oncoming procession. The procession of visiting chiefs, followed by their public—a motley crowd afoot and in automobiles—turned in the gate and took up similar positions across the fire but toward the road. The two guardians of the singer ranged out to flank the front line of chiefs. On reaching the fire the singer stopped, and Sái''go·na (Big Knife), David Thomas (Oa.), took a central position next to Chief Logan as speaker for the Three Brothers. Deputies formed the second line, matrons and the public ranged behind. At the wood's-edge fire was enacted a scene worth filming (Fig. 1): the two crowds divided by the fire and five yards of common; dead chicory and frosted asters; smoke arising through bony limbs of shagbark hickories above the Three Brothers; cars, women, babies, men in finely tailored suits and overcoats, some in overalls, but none in native costume. One of the scouts glanced apprehensively in our direction where we stood apart east of the fire so as to review equally both moieties. But we held to our pledge not to take pictures, and the scouts relaxed when they saw we meant it.

A representative of the Four Brothers side, a tall spare figure whom we recognized as Alex General, who bears the title Desga'he', belonging to the Upper Cayuga band, stood to the fore near the fire leaning on his cane and waiting for the Three Brothers to come up and form ranks across the fire. Now he took up his cane and paced slowly to and fro chanting the measured phrases of welcome. This act they call Deyothnyongwaarakte', "Beside the thorny brush," or "At the Wood's Edge." The words in Mohawk are as printed in Horatio Hale's *Iroquois book of rites* (1883), but in performance the phrasing is entirely different, as I discovered on recording the chant. In chanting, sentences are not differentiated and it takes all one's breath to express one word:

Onenh wenisseraa'···de'—now today
wagadyerengoo'···wa—was I greatly startled
deshawennawe'rade'—by your voice coming
ne' Kendeyohhoo'···don'—to this clearing (opening).

One is reminded of high Anglican mass. Desga'he' had typed out the words from an old penciled script by John Doctor, and there is no telling whether Doctor had it from Hale or from the same source. But Desgáhe' managed without the book until toward the end, there being not quite a hundred "words" (phrases) to remember. Thus for centuries the grieving tribes had greeted the condolers, "Great thanks that you have passed safely diverse obstacles and dangers that beset your journey [except for 200 yards of clay, a gravel road connects Onondaga and Lower Cayuga Longhouses]; journeying you passed places where the Founders on whom their faith rested used to meet." The Cayugas speaking say, "My Father's Clansmen, how can your minds be at ease when you kept seeing the traces of our forefathers, and barely perceptible is the smoke still rising at the places where they used to smoke in council, they who sustained our minds, and you saw on your journey the traces of their labors? How then can your minds be at ease, when from your eyes tear drops hang repeatedly, My Uncles? Thanks greatly that you have reached here safely. Now we both have come together (with tears in our eyes) and sat down (across the fire) [but they now stand]."

The chanter goes on to conjecture the awful calamity of a death on the trail, or some similar disaster to one of the chiefs. But the founders ordained that a fire be made at the wood's edge, where they shall condole each other briefly; they will employ but three words, reserving the principal matters for inside the house where the main business is transacted; then shall they rub down each other's bodies; there shall they be taken by the arm and seated on the main bench.

A list of town names founded by several maternal lineages concludes the chant. First come settlements of the Wolf clan, the two clans of the Turtle who are offspring, and the Bear clan who are Brothers. Some place names are now obscure; others resemble town names of seventeenth-century Iroquoia. These were the clans of ancient times (belonging to the Mohawk and the Oneida).

THREE RARE WORDS OF REQUICKENING[3]

The first chant ended abruptly. Once more Desga'he' stood in the central position before the fire resting on his cane. Hagya'-trone', at his elbow, produced the first three strings of Requickening, which are of variegated purple and white wampum beads. Originally a horizontal pole resting in forks of two uprights held the wampum strings at the fire beside the trail. But today Chief Alex Nanticoke, who keeps the wampums for the Cayugas, let the three short strings hang from his hand. Nor had the Condoling phratry set up cross poles for receiving the strings. It was a surprise to me to see the Mourning chiefs send over the first three strings to the Clear-minded, because Hewitt (1944, p. 70) assigned this role to the latter; but it was to clarify such issues that I had waited ten years and come to Canada to witness the ceremony.

We did not record Chief General's words in Cayuga because Hewitt and Goldenweiser had them from earlier informants. With the first string the speaker for the mourners acknowledges the Creator's part in making the day and causing the number of persons, who have come on the road with tears in their eyes, to reach the appointed place where the fire rests at the wood's side. The Four Brothers think it wonderful. Now he wipes away their tears with the white fawn skin of pity to enable them to look around with clear eyes and notice passing persons. Having calmed them, his messenger (Howard Skye) took the first string of wampum over the fire to the Three Brothers where it was received by Chief Logan. Similarly, the speaker proceeded to remove obstructions from the ears (second string) and throat (third string) of the Clear-minded.

Now enabled to see, to hear, and to breathe freely, the speaker for the Three Brothers replies to the mourners. The Clear-minded confirm what the Lower folk (Cayugas live down the Grand River) have done, giving them to understand that they approve of the number of matters so far uttered. "Further," say the Three Brothers, "what befell you is not a one-sided affair [it affects both moieties], which is the purpose for the Three Brothers' coming. What a calamity has befallen the Four Brothers. Yea, a seat is vacant in the place where you all customarily assembled. Now a man has died toward whom the people used to look and direct their minds. Now the bench is vacant. And consequently you the Four Brothers are in the midst of great tears."

Now the Three Brothers customarily wipe away the tears to enable the Four Brothers to see what transpires on earth, etc. Here a deputy for the Condolers carried the first string back over the fire where it was grasped by the Cayuga wampum keeper (since both sides have their own sets of Requickening strings, the strings go back in succession to the owners).

And so the speaker for the Three Brothers, the Clear-minded, proceeded to open the ears and remove the obstructions from the throat of the grieving Four Brothers, sending back the two remaining strings, one at a time, by his deputy as he completed each word.

Now somewhat assuaged—able to see, hear, speak, and breathe freely—by the Three Rare Words of the Wood's Edge ritual, and fortified in their minds by the return of their wampum strings, the mourning Four Brothers (via their speaker) say, "Now have we completed it. The preliminary words are over. We both have rubbed down each other's bodies. Everything on our side is now ready; they shall take you by the arm and lead you to the principal bench (ganakdagweniyo"geh, the main bed), and there shall one seat you in the place where the entire business will be carried to a conclusion, as many matters as remain for us. Thus the appointed warrior chief will take you by the arm there and he will place you where benches have been prepared for you."

It was at this point that I saw Howard Skye for the Cayugas and Albert Thomas for the Oneidas, the designated Chief warriors for the Four Brothers, step across the fire and turn together to face the west entrance to the longhouse. The two warriors stood together, as custom dictated, in front of the two who led the procession on the road, the singer and the crier for the

[3] *See* the author's edition of J. N. B. HEWITT, *The Requickening Address of the Iroquois Condolence Council*, This JOURNAL 34: 65–85. 1944.

Three Brothers. Meanwhile the host of the Four Brothers, having turned away from the fire, were making for the east door of the longhouse to find seats. Supposedly the chiefs precede the crowd into the building. Actually, many from both sides had crowded in already to preëmpt the best seats at each end.

Then the two appointed as head warriors say, "Onenh dwa'den'dya," "now let us proceed."

Again taking up the Roll Call at the place where he left off when they reached the fire, Roy Buck, who was following the path, started the procession of Three Brothers toward the west door of the lodge. Those names of founders that were not sung before on the road are sung now up to the door. It was 4 o'clock as we entered the longhouse behind them, having passed nearly an hour shivering by the fire.

At the door of the longhouse it is customary to have another man appointed to take over the Roll Call and recommence from the beginning inside the house, regardless of where the first singer leaves off. We came in and took seats on the left bank behind the chiefs, who occupied two opposite benches lengthwise of the house in the northwest corner, and a third bench placed across the west end of these facing the Four Brothers side. The latter sat on two opposing benches similarly placed in the northeast corner; I could not see a third bench from where we sat against the north wall behind the speaker's bench. Men occupied the north half of the house at both ends; women and children sat to the south. Midway of the house a wire stretched across the room, as if to demarcate the zone of the Clear-minded from the Mourners, and a blue quilt fitted with curtain rings hung in folds against the north wall. As we seated ourselves, Onondaga Chief Peter Buck, who holds the title Gowena'seńdon', was walking slowly to and fro, cane in hand, the whole length of the house on the men's side, chanting the Eulogy of the Founders. Now it was apparent why the Hai Hai singer must rehearse. He must have the words fixed in his mind; he must remember the Roll Call, how the chiefs are related, as brothers or cousins, and how to divide the words to fit the tune. From the moment he crosses the door sill confusion greets him. The mourning side is seated, but his own crowd is coming in. Escorted to the bench prepared for them, the chiefs sit down, but the crowd scrambles for seats along the wall. The west door keeps banging (and the Lower Cayuga Longhouse door creaked badly). The air is already fouled: chiefs light up their pipes and cigars; the stoves at each end alternately radiate intense heat or smoke. Babies cry. But the measured phrases of the Roll Call go on inexorably for an hour[4]:

Hai Hai Now continue to listen
Hai Hai Our grandfathers of old
Hai Hai You did establish it
Hai Hai The Great Law (League)
(Seventeen "words" precede the first name),
Hai Hai (four times)
Hai Hai Continue to hear us
Hai Hai You who were proprietors
Hai Hai Ne Dekarihoken
Hai Hai They were related as brothers
* * * * *
Hai Hai that was the number of you
Hai Hai you did work together
Hai Hai you did found
Hai Hai The Great Law
Hai Raksot (Grandsires)

And so he goes on, mentioning all the names through the rosters of five tribes on both sides of the fire, as they are sires or offspring of each other, going through it to the very end as far as it was completed when the League was founded. Moreover, while he is walking to and fro performing the ceremony, each time he comes to that part of the chant when he says:

Hai Hai ne'to hona'deedjon''na
Hai Hai swa' deihwakhahon''gwa
("That was the number of you founders"),

then the chief so denominated cries in approbation "yoo hen^{na}——" (in falling tone), and all the chiefs of his phratry in unison confirm (in low tone) "hii····· ye^{n}" (stressing the last).

And likewise on their side of the fire, when the tribal chiefs of the Four Brothers hear their titles announced, one after another each chief of that nation himself

[4] J. N. B. HEWITT and W. N. FENTON, *Some mnemonic pictographs relating to the Iroquois Condolence Council*, This JOURNAL 35: 301–315. 1945.

raises the shout of approval, and his own phratry of chiefs support him.

But when the enumerator reaches the vacant title for which the ceremony is going forward to install a candidate, both on the road and inside the house, according to Roy Buck, he inserts an address to the deceased chief and his ancestor:

Hai Hai Know that she (society) is grieving
Hai Hai They are mourning
Hai Hai In their minds
Hai Hai When he did pass away
Hai Hai He on whom we depended
Hai Hai He carried away with him
Hai Hai the minds of them
Hai Hai who subsist on the stump[4]
Hai Hai as the tree puts forth suckers
Hai Hai Now thou deceased one listen (hear me)
Hai Hai You were a principal one (a chief)
Hai Hai You Daga'en'yonk

There is only one principal candidate named, in this case Haga'en'yonk, first on the Cayuga list, for whom the Condolence is performed; if others are then installed they remain unnamed.

And then the enumerator continues as before until he completes the roll of the Five Nations. The Roll Call ends abruptly without flourish, leaving the singer midway of the house, from whence he returns unceremoniously to his place among the Clear-minded chiefs and sits down.

It was now 5 o'clock. It was gathering dusk outside, and the six windows, three on each side of the house, no longer admitted enough light to illumine the interior, although the logs above the wainscoting had been whitewashed. Originally built of pine logs, sometime after A. C. Parker and F. W. Waugh photographed it (ca. 1912), Lower Cayuga Longhouse evidently was rebuilt and clapboarded on the outside when, presumably, the transoms above both end doors were boarded shut. Now the two messengers for the visiting chiefs, Sam Silversmith and Bill Henry, who had guarded the singer on the road, took down the oil lamps from the chandelier at their end of the house, adjusted the wicks, lighted them, and put them up again. Simultaneously, Bob Bill and Freeman Gibson, two of the cooks who hang the kettles for the chief, fulfilling further their duties to the matrons who appointed them, came in from the cook house and lighted the lamps on the Four Brothers' side.

[4] The chief's maternal family and clansmen.

SIX SONGS

Meanwhile the two servants of the condoling chiefs drew the quilt curtain halfway between the groups of chiefs screening the mourning Four Brothers from the Clear-minded who were about to sing. Across the room the women folk could see the whole length of the house.

While this was going on, at the Three Brothers' fire before us, a cane was put across between opposing benches at the end toward the curtain and the Four Brothers' fire. Seneca chiefs sat toward the curtain end, Onondaga chiefs in the middle, Mohawks at the end toward the door, and on the flanking bench facing the far fire, Seneca Chief Adam Burning, holder of Sha'degeonyees, "Skies of Equal Length," held one end of the cane; Thadoda'ho' (Onondaga) grasped the near end; beside the latter sat the Speaker. Over this horizontal stick were draped in order all 14 (?) Requickening strings. When all was ready, Chief Logan, who at the rehearsal had been appointed to perform this role for the side of the Clear-minded, raised the first of the Six Songs. The old chief leaned forward resting elbows on knees, hands clasped; and most of his colleagues assumed the same position. Their heads were together as if deliberating some solemn question in council. Indeed, singing the Hymn of Farewell to the Dead Chief is a solemn occasion for which they had practiced. Now they excelled themselves. No other song is so sacred to the Iroquois. Nothing else quite embodies their feeling for the League. It is tragic but understandable that they will not sanction recordings. Chief Logan drew a deep breath, closed his eyes, and his clear baritone voice sang out:

Hai Hai hi hi i hi:] *repeat*
Gayanerenh De skennon—
— — — wero neh i
Hai Hai, etc.

The leader went over the song to its very ending (yenh!); then another appointed one, young Roy Buck, picked up the song

a second time from the beginning, whereupon all the chiefs of the Three Brothers' side sang in unison, continuing through the entire song until the last *hih* fell away, and in unison they echoed, "yenh!" The long sustained notes, the breathing in unison, the division of the words to fit the meter so that a verbal suffix commences a new line, and the characteristic ending strike an outsider all the more if he knows the music.

1. Hai Hai Gayanerenh deskenon—weronne' Hai Hai
   Hail Hail the League, I come to greet it.
2. Hail Hail my nephrews (offspring), I come to greet you.
3. Hail Hail The Warrior chiefs, I come to greet you.
4. Hail Hail the Matrons, I come to greet you.
5. Hail Hail Our grandsires—what they decreed.

All but the sixth song are sung in sequence. In performance, as in recordings from David Thomas, I recollect that Chief Logan sang no. 2 as his first, greeting the nephews before the League. Also, contemporary ritualists are confused about the fourth song, as to whether *wagonnigi* refers to the Matrons or to something that was established by the founding great grandfathers. Hale gives it as obsolete for "womankind." As the response to the fifth song died away, a deputy of the Clear-minded drew the curtain aside. It was then a quarter past five.

At the rehearsal, the Clear-minded chiefs had appointed Peter John to take the next part. Being a Mohawk it is easier for him to remember the words of the ritual. He arose, cane in hand, adjusted his spectacles, and glanced at the text, which he had written out in a notebook, before starting to go the length of the house between the two fires on the men's side, chanting,

GAHAWENHÄÄ"DI', "OVER THE FOREST"

1.

Hai Raksothaa'·hi'h
(The chanter prolongs the penultimate of each phrase.)
Hail, Grandfathers,
now continue to hear us.
Now do they weep mournfully,
your very grandchildren.
Now at this time
it has become ancient (people are no longer interested),
that which you all did establish,
the Great Commonwealth (the League).
Hail Grandfathers, Hail.
Only that it were true
that you might continue to hear us.

2.

Hail, Grandfathers.
This is what you said,
that society would become destitute;
and that they who are coming in later times
shall pass this way (in the ceremony).
Hail, Grandfathers.
Even now,
one is uncertain
just how to recite the ritual,
as they were wont to perform it.

3.

Hail, Grandfathers.
Now at this time,
has it grown old,
what ye did establish,
the Great League;
you have it as a pillow under your heads,
beneath the ground,
where your bodies are resting
ye who combined your affairs into
the Great Law (or the League).
Would that it were really true
that you might still hear us.

4.

Hail, Grandfathers.
Isn't this what you decreed:
In the far future this institution shall be carried on,
that the law shall be continued
by our grandchildren'?
Hail, Grandfathers!

Having intoned four verses, Peter John returned to his place among the condoling chiefs, the curtain was stretched again, and Chief Logan lifted up the final verse of the hymn, the sixth song:

6. tciyatonde·k ne'i· he
   tciyatonde·kh :]&
   Ronkesota tciyatonde·k ne'i :] D. C.
   Continue to listen, my Grandfathers.

As before, the singer went over the song completely before his assistant picked it up, when all the Lords of the League among his colleagues repeated it.

Once more the curtain was "lifted." It was now a quarter to six.

Peter John again stood up and resumed chanting, continuing from where he left off to recite the laws of the League, as he passed to and fro the length of the house. During Part 2 of "Over the Forest" he

consulted his notebook, interrupting the regular cadence of the chant, so that the words did not advance with his feet as when reciting from memory.

The founders decreed that these things would make the house firm, i.e., reinforce the League. "Having completed the structure, we made marks of identification; we crowned ourselves with symbolic horns of authority."

The founders provided for succession to office. When a chief's life sways as a giant tree between life and death, then shall his antlers of office be lifted off and set on the bed between him and the wall, for it would not do if they should be borne away into the earth by a person passing away while invested with horns. Should this happen, they said, we should all perish. The founders thought, in such an event, it would be the proper way and it would strengthen the league to replace one person with another of equal status. Should the mistake be made that anyone suffers the consequences of being murdered, then shall the corpse be placed properly next to the wall where it shall rest in the darkness.[6] (Likewise his kin are in darkness of mourning.)

[6] The late Simeon Gibson thought that this passage refers to former platform burial, either outside or within the house. At the founding of the League the proper way to care for a corpse was to dress it and put it up overhead on the ceiling (not upstairs, as there were no stairs, but on the shelf over the bed where it is dark), and abandon the house altogether. That was their "system" and they knew no better. This former practice is attested in tales of the Vampire Corpse. Young men sleep in abandoned dwellings to be awakened by gnawing; in the morning a companion is dead, mangled, and they find a corpse overhead with bloody mouth. Survivors return home and notify chiefs in council who consider and decide to change the "system": "Henceforth we shall bury a dead person underground."

The founders decided that, lest sunlight might discover the corpse to a child who habitually rummages everywhere, they would save her a possibly awful experience which would torment her mind until she learned why the corpse was lying there; they would uproot a lofty pine tree, making a great hole, and there into the pit they should cast this thing and the swift current would carry it away. Then would they reset the pine tree, and never should their grandchildren see it again.

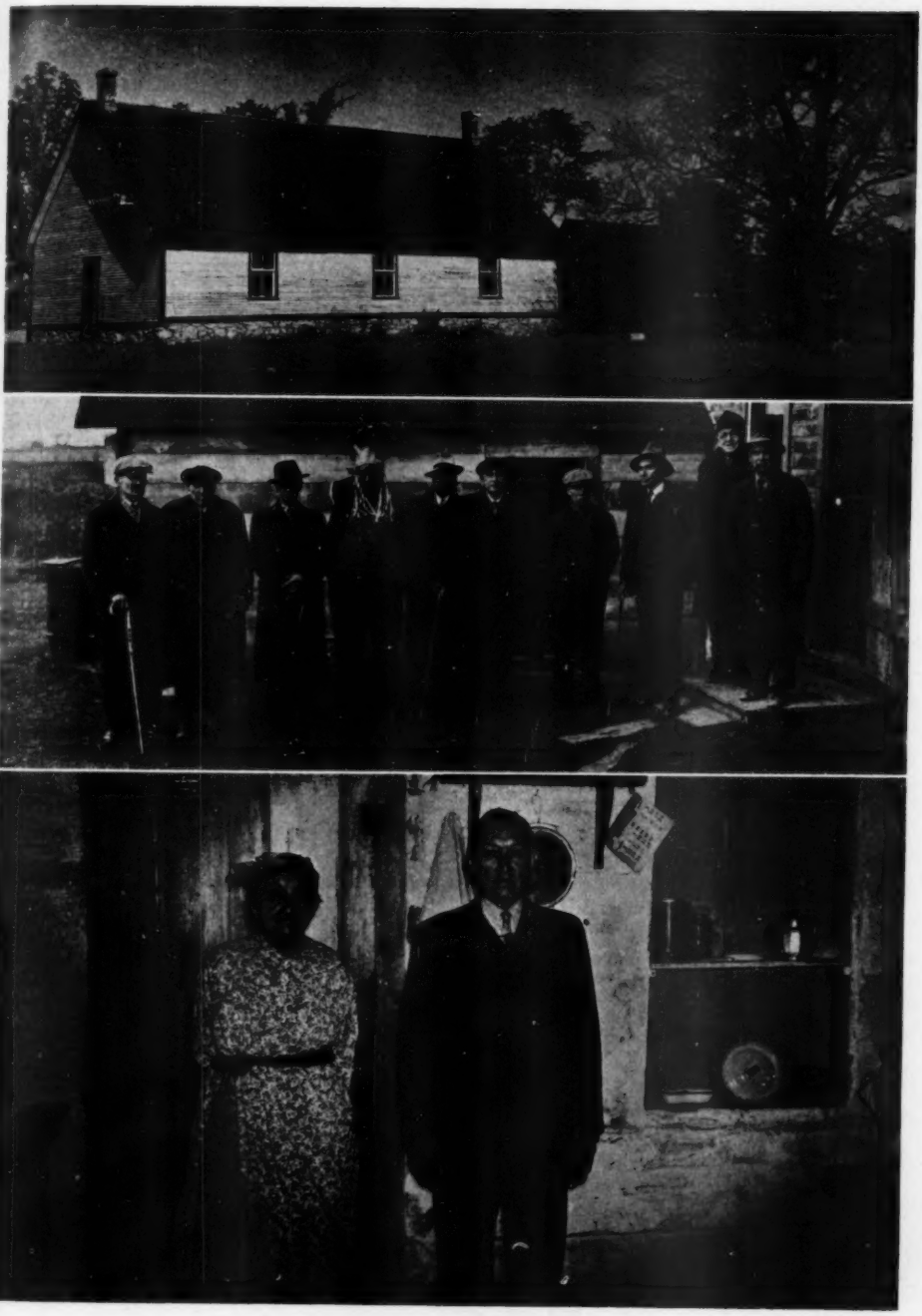
And they provided for a Condolence to strengthen the house. "Allowing that now we all wear symbols of identification, we are all invested with antlers, the pity of it being that ere we may return to our seats something may astound our momentary repose. In the event of a loss," they said, "this is what we shall do: we shall place a pole across and on it hang a pouch [of some burrowing species (?)], and in it we will drop a string, the short string of mourning, to go to either side that is mourning. Whereupon the Clear-minded shall remove it and follow the path and go to the place of mourning. There at the edge of the dust (at the bare spot around a building) one shall speak words of sympathy which at once will lift up the mind of the mourning person and comfort her. Now shall the person take up the path (resume her duties) of the Great Law (in the League).

Finally, the originator of this Confederacy
you yourself, Deganawii'dah;
and his son, Ho'datche'hde' (Oneida head chief),
ye both were joint proprietors;
and *his* father's clansman, Dehadodaa'hoh (Onondaga),
ye both were founders;
and his son, Haga'en'yonk (Cayuga),

FIG. 2 (upper).—Lower Cayuga Longhouse. From the distant road the condoling chiefs of the Three Brothers tribes entered the near (west door); the mourning Four Brothers, including the Cayuga hosts, used the far door next to the cookhouse. Photo by courtesy of Cranbrook Institute of Science.

FIG. 3 (middle).—The Clear-minded or condoling chiefs of the Three Brothers Side before taking up the path for Lower Cayuga: (left to right) James Martin, *Tekariho'kenh* (M.), Peter John, honorary Mohawk chief and chanter, Deputy chief Levi Hill, Charles Silversmith, *Hahstawen'seróntha'* (M.); Freeman Green, *Gane'sáh'henh* (Oa.), Joseph Logan, *Thadodaáho'* (Oa.), William Jacob (?), *Hononwiéhdih* (Oa.), Peter Buck, *Gowenna'séndonh* (Oa.), Eulogy singer; Johnson Sandy Ganonhgei'daáwi' (S.), Doorkeeper; and William Henry (Mohawk), runner for the chiefs. Absent from the picture were David Thomas (Oa.), Speaker, and Roy Buck (Cayuga borrowed by Onondagas), singer of Eulogy on the Road.

FIG. 4 (lower).—The matron stands with the candidate for chiefship who is crowned with the symbolic antlers of office. Jemima Gibson, matron, and her brother Chief John Hardy Gibson (C.).



FIGS. 2–4.—(See opposite page for explanation).

ye both were principals;
and that one, a father's clansman,
Sgania'dai'yo (Handsome Lake) (Seneca),
you, his cousin,
a joint proprietor,
Sha'degaenhieiis (Skys of Equal Length).
(These were the founders.)
Now this is what they considered:
In later times additions would be made to the framework,
to the great sooty rafters.
Hail, Grandsires.
Now are we failing
your very grandchildren.
Hail, Grandfathers!

Ending on this note of humility, the chanter returned to the bench of the Clear-minded. It was 6 o'clock by the time Peter John had finished. When he was seated, Sai"goonah, Great Knife (David Thomas), as speaker for the Clear-minded, stood up and addressed the Four Brothers, resuming the Thirteen Matters of Requickening.

REQUICKENING (PART II)

Although not himself a chief, David Thomas has the confidence of the Onondaga council and speaks for them. From the years that they were team mates at Lacrosse, Chief Logan and David (Da'wit) Thomas have relied on each other. Now they collaborate in ritual. "Old Da'wit," as he is affectionately called, is one of the finest orators among the Six Nations. Of Christian parents, he grew up, nevertheless, among the longhouse people, marrying a daughter of Old Chief David Skye with whom he took up residence. The old chief used to rise early before daylight; Da'wit would get up and "make fire," when the old man would begin to talk about the old people, their customs, traditions, and ceremonies. Once fairly started, Chief Skye would keep on whether or not anyone was listening. But Da'wit, then a young man, would listen—chin in hands, elbows on knees, and eyes shut—concentrating on the old chief's words. Thus he heard much of the Deganawii'dah legend of the League's establishment; that is how he became versed in the lore of the longhouse, the religious festivals of thanksgiving; and by participating in the ceremonies and by dint of long practice he became a longhouse speaker. Thus Iroquois society leaves a way open for an individual to achieve what cannot be ascribed to him if his maternal family does not possess a title.

What are the qualities of a good speaker? What is it that Da'wit has that others lack? He waits for his audience before speaking. Then he commences slowly in a low, well-modulated tone of voice. He is a master of the period, allowing as much time for his words to sink in as passed in utterance, meanwhile standing with eyes nearly closed concentrating on what follows. As he warms up to his topic, the pace quickens and the words flow in swift cadence at a high tonal plane, which falls away at the end of a clause or sentence. This is the "preaching" style employed in the Requickening Address, as in other ritual speeches and prayers that are recited from memory. What impresses the white man, even after a decade of association with the Iroquois, is the utter equanimity of public speakers who carry on "in a crowd," as they say, undisturbed by crying babies, doors that bang and groan, the coming and going of children, adolescents, women, and men who get up and go out—even their colleagues, the chiefs for whom they speak. Such poise demands not only concentration but knowing the stuff of ritual thoroughly. Besides the "preaching" style, there is the oratory of the council. Argument calls up a wealth of figures of speech in which the lore of the longhouse abounds; and on such occasions Da'wit employs gestures as graphic and artful as his voice. Irony, even sarcasm, and above all a sense of humor appeal to the Iroquois as Indians.

Having cleared the "eyes," the "ears," and the "throats" of the mourning phratry of the deceased chief at the wood's edge, the speaker now proceeds to requicken the remaining organs and faculties that were impaired by the awful hand of Death. Grief, says the fourth "word," wrenches the internal organs, and the speaker rearranges them by pouring in the "water of pity."

The fifth burden wipes clean the bloody husk mat bed.

A sixth lets daylight into the deep darkness of grief. The mourning phratry regains

sight of the sky, which the Master of Life intended as a source of happiness. The eighth burden restores loss of the Sun with all that sunlight implies to a horticultural people.

The mourner's mind rolls atop the fresh grave of the dead chief, which calls for a ninth black string of wampum. Death, the Great Enigma, has scattered the bones of the Founders; the Clear-minded send over a string (of white wampum in some sets; half black and half white in others) called "Twenty Matters" with which they "do bind up the bones of the chiefs and the nation"; Twenty is the penalty for homicide. (This string goes over to the Four Brothers but does not come back until the next Condolence.)

Moreover, death has stomped in the Council Fire and kicked around the fire logs; the eleventh string restores the Council Fire (civil government) so that neighboring people may see the smoke arising and take heart.

The twelfth burden acknowledges the preeminence of Iroquois woman: birth of men, attending the hearth, preparing food, care of all that is planted; an early death leaves that much empty space in future society for the children she did not bear, and since she lacks female descendants the ashes of her maternal family become cold. The warriors are woman's assistants.

The Federal Chief follows the path of duty (XIII); his nephew (warriors) and a niece (women folk) are his immediate care; and the matron warns him when he strays from the path, but if he throws her warning over his shoulder, then the head warrior warns him of drifting from his colleagues and puts him back on the path. The nephew and niece appear a third time, and the chief warrior of the family lifts the horns of office and hands them to the owner of the title, thereby releasing the man of further duties as a civil chief.

The fourteenth burden admonishes that "anything can happen on earth," even insanity or suicide following so grievous a calamity as the death of a chief. Certain plants growing on earth are not to be fooled with; some are medicines but included in them are some poisonous plants that will kill a person should she lose her head and fool with them.[7] (A string, half black and half white.)

The last burden of Requickening speaks of the "torch of notification," by which they learned of the chief's passing, and returns to the pouch on the pole the short (purple) string which both sides own equally and use for this purpose. The string symbolizing the torch is pure white.

"These are the number of Condolence Messages."

As he spoke each of the 12 condolence messages in the longhouse, Da'wit lifted the appropriate string of wampum from the cane beside him between the benches, where the "words" were ranged in sequence, and held the string in his clasped hands until the end of the message when it says: "Now, my offspring, you Federal Chief, whom I have held to my bosom, the Word (attesting wampum string) of thy *Ado'nni* (father's clansmen) is on its way to thee." Here the deputy for the Three Brothers took the string from his extended hand and carried it over to the Four Brothers' side where it was received and hung on the cane. In all, 12 strings crossed from fire to fire during three-quarters of an hour.

But there was one other. This explains why some informants speak of Thirteen Matters inside the house, although Howard Skye said but 12 strings crossed the fire in the present ceremony. The speaker now requested the Four Brothers to pay strict attention.

Now the Three Brothers have been noticing that the mat (or bench) is empty where your colleague used to sit. The Founders of the League ordained how many trees shall stand erect on both sides of the fire and how to proceed in case a body topples on either side. In that event it shall be urgent that they shall show the candidate's face in front of the chiefs and the public, and that also they shall stand him erect and mention his name. That is why the Three Brothers came here because now the bench is empty where his bench used to be on whom the minds depended. Now that one is gone wherever it took him.

Now then, point out to us the one who is to be our colleague, so that we may think that the number of words that we have spoken here shall be fulfilled.

[7] FENTON, W. N. *Iroquois suicide*. Bur. Amer. Ethnol. Anthrop. Pap. No. 14, Bulletin 128, pp. 80–137. 1941. See also footnote 10.

Now, therefore, our means of notification (the short string of black wampum that was brought to the Three Brothers by a runner when the Cayuga chief died) now goes back to you. (Deputy carries short string across.)

Now shall you know that the Three Brothers have completed the ceremony, for this is the number of words.

Three hours had passed since the Condoling phratry had entered the longhouse; it was now nearly 7 o'clock. With the end of the address, Da'wit said, "We are now going to rise as a group and withdraw a little way as far as the edge of the brush to kneel and crouch there until further notice."[8] At once the chiefs made motions as if to leave. Some made a noise with canes; others got their hats and coats, picked up canes, and a few stood up. Across the room, Howard Skye, as messenger or chief warrior (sometimes a chief does this) for the Four Brothers, stood and briefly addressed the guests, "My uncles, we ask you kindly to remain until further notice. That is all."

Somewhat composed, the Three Brothers sat down to await a reply.

MOURNERS RETURN CONDOLENCES

It was now the obligation of the mourning Four Brothers to return the condolences of the Three Brothers. Accordingly, their deputy drew the curtain. There on a cane before the Four Brothers rested the 13 strings of wampum, which are the words of the Three Brothers. There with them also rested the Six Songs. But they too had rehearsed and they had appointed a singer and a speaker.

Only four chiefs represented the Four Brothers, of whom three are Cayuga and the other holds an Oneida title. Besides Desga'he' and Hagya'throne', there was Deyotoweh'gon, "Doubly Cold," a title which Sam Jamieson holds, and only Howanhtcade'nhon, "Covered with Mist," in the person of Levi Jacobs, sat for the Oneida Nation. S'ohee's, as deputy for Deyotowe'hgon, acted for the side; and Charley Van Every, home from Lockport, N. Y., carried the Six Songs, followed by Alex Nanticoke. This fragmentary delegation for the Younger Brother nations sat mixed without regard for rank or tribal affiliation, nor was my informant certain how they should sit.

The Four Brothers' side returned the Six Farewell Songs of the dead chief at one sitting behind the curtain, beginning at 6:50 and singing 20 minutes. They were not in so good voice as the Three Brothers. The manner of singing did not change: the first singer went through the song and the follower led off from a lower note; then all the chiefs of that side joined in. But the words differ. It is as if the past chief himself sings:

1. The Law has come to greet me.
2. My Father's kindsman comes to greet me.
3. The warrior comes to greet me.
4. The cook[9] has come to greet me.
5. Our grandfathers, what they created.
6. Continue to hear us, our Grandfathers, continue to hear us.

The last is the same as the sixth song sung by the Condolers.

The deputy for the mourners put back the curtain for the last time, and Desga'he', who made the principal addresses for that side, stood. He proceeded in great deliberation to return the burdens of Requickening. Confirming each burden, however, was briefer than condoling. Not quite a half hour sufficed. And of the 12 strings that Da'wit had sent over, only 11 were returned by the deputy, one at the end of each message. Dr. Hatt counted 10 coming back; Howard Skye said he delivered 11 to the Three Brothers' side, that the Four Brothers kept the one called Ne'Dewas'hen' niuihwa' (Oa.), "The Twenty Matters." This string is passed over by the Condoling phratry to confirm the tenth burden which says,

[8] This being the old custom to retire and await summons to hear the reply of the home council.

[9] Jemima Gibson said that each chief has a godri'hont, a female official, who is appointed in her own maternal family, at the same time that the chief is raised, for life and who is replaced at death by another, but is not the same as the goyanehgo·nah, or *Matron* who appoints her. Her duties are to cook the corn soup in making a new chief, to make corn bread (if she is smart), and to boil the meat. At a special council, if special meals are needed, the chief may call on his own cook and ask her to fulfill her duty, i.e., cook the corn soup. But we have already noted that men were cooking under the direction of women.

"Now then does one[10] gather your bones together;
With Twenty Matters do they bind up your bones."
(i.e., of the living and the dead chiefs).

This string will be returned at the next condolence held at Onondaga, when the Four Brothers will send it back; unless a second condolence falls at the same place, when the string is sent back "by a whisper" (aja'honskwa' (Ca.)). Regularly, this string keeps going back and forth whenever a condolence occurs, although, I believe, each side possesses such a string.

Except for the omission of the Tenth Matter the reply of the Four Brothers otherwise was the same as the condolence expressed by the Three Brothers.

In preparing the return of condolences, the speaker for the mourning brotherhood will say,

Now today the ruler has made just as he prepared the daylight and even the earth, and he created us people, and, therefore the number of us present. Now we are two groups met together, my uncles. And, moreover, already did you make an address, and so it is the turn of the Four Brothers to reply. Therefore you shall all think that we have accepted it too, just as you delivered it. Now you did finish speaking. Furthermore, this is how our grandsires have ordained; they composed words for carrying on on whichever side of the fire the chief may have died. And then the clearminded shall come in at the door (of the mourner). Accordingly you are following this path, my uncles. And what is more it isn't just on one side (death may befall either side): it is happening to both of us alike. Thus from day to day they are toppling over close to thy person, they are dying continually, thy very newphews and even thy grandchildren. Consequently right now it is twisting within your mind. Therefore, now they have poured in the decoction of sweet flag (water of pity), and when it has settled down it will permeate throughout your body. Then shall you feel well disposed in the future, and you shall continue to enjoy health for a day at least.

* * * * *

This is the way the Four Brothers may do, repeating then the 13 (?) strings exactly as given by the Three Brothers.

SHOWING THE NEW CHIEF'S FACE

It was 8 o'clock by the time the Four Brothers had sent the last of the Requickening strings back by their deputy. Now Desga'he', their speaker, took the center of the floor beside their fire, and, leaning on his cane, addressed the Three Brothers:

You now have the completed words of both of us, the number of my father's kinsman. And now it will be possible to show his face right here before the crowd. Now one will raise him to a standing position in front of the chiefs and also one shall call his name, which is that of the dead chief. Now another thing, one will place him in the vacancy. Now, moreover, my father's kinsmen, you shall think that events have transpired here just as you specified when you did say, "Now show us the new man who will be our coworker from now on." Therefore, be alert for this is the real thing! Now you shall take a good look at him. For we are now going to show you your future colleague!

Although others besides myself including some of the Chiefs on the Three Brothers side knew who was going to be the chief, no one let on, and the tension built in five hours of ceremonial reached a climax. The building overflowed with anxious humanity; just before this Dr. Hatt had counted over 80 persons over on the women's side, but now others crowded in at both doors, standing up to the stoves, to see the new chief. Probably the crowd touched 250 at its peak. Jemima Gibson, matron of the family holding the title Haga'enyonk, arose as Desga'he' was speaking and crossed calmly from her place among the Cayuga matrons in the southeast corner to where her brother was sitting in a complimentary place among the Cayuga men in the northeast corner. Taking her brother Hardy by the arm, she raised him to his feet and escorted him to a position just flanking the fire on the speaker's right (Fig. 4). As this action occurred, the Chiefs of the Three Brothers' side and the multitude craned their necks to see the new chief. There they stood, the speaker in the middle of the house, the matron on his right, and the candidate on her right, facing the Three Brothers' side.

Now the speaker for the Four Brothers side went on, "Now all of you look here, for he is standing here before you, the one who was appointed by the owner of the title which reposes in that continuing lineage, the Bear Clan, whose bench was made empty where their late great one used to

[10] Throughout the ceremony, as in Iroquois generally, the third person singular feminine, "she," stands for society; "it is as if a woman is doing it."

sit." (Here the speaker mentioned that the deceased Haga'enyonk, the late Abram Charles, was a member of that clan, and that he had been qualified as a chief when yet a boy, but he did not state the details of his elevation.) "And further, this one (the candidate) who came and stood there in front of you is the one whom they are crowning with antlers (of office) and henceforth you all shall denominate him Haga'en'yonk." (This name he repeated for emphasis.)

Actually, the candidate was crowned the moment the matron stood him up.

"Now, therefore, here is the means by which you may hear the title, Haga'en'yonk." (He held in his hand a string of white wampum which, when he had finished speaking he passed to his deputy who carried it across the fire.) "It shall now go across the fire; it is the word of all who have combined their voices with the proprietress of the chief's name, comprising both the siblings and the cousins who sanctioned it; and also the entire group of relatives have approved it; even the tribes known as the Four Brothers are of one voice. Now, therefore, it shall cross the fire, now their word by means of which you shall be notified, is on its way over my Father's Kinsmen, the Three Brothers" (string).

Ordinarily the matron of the nominating maternal family chooses a lady to stand with the new chief, to serve as his guardian, and also to cook for his feast, according to Simeon Gibson. But Jemima, the matron herself, stood alone with her brother, and no man was installed as deputy to run his errands. Younger members of the family had refused to accept responsibility. Accordingly, the orator referred only to the matron, if he said, "Furthermore, this person will be his guardian to stand at his back as the women owners of the chief's title have severally agreed, and they have attached her to his body and stood her to the forefront at the head of the women of the maternal family of that clan when they stood him in the chiefship. She shall be called (name of head female of chiefly family), for which this string of wampum will cross the fire."

The deputy of the Four Brothers carried the string of notification across to the Three Brothers' side. The first chief took it, handled it, and passed it on to his colleague; and so the string went around the fire in a counterclockwise direction. Each chief touched the string as it passed among them; taking hold of the wampum is tantamount to consent. Each chief has his own string, called "his guardian." This goes over the fire, and every chief handles it as it circulates in the council confirming the appointment. Earlier informants said that this string is returned with a speech, but Howard Skye asserted that this string is gone so far as the matron is concerned. One such string, anyway, is kept by the matron who watches the chief. Jemima, the matron, returned to her place among the women, leaving her newly crowned candidate to the scrutiny of the Three Brothers.

But the Three Brothers did not reply as yet, because the Four Brothers had yet another candidate. The installing speaker continued; yet another title was vacant in the Cayuga roster. Mrs. Charles Bomberry of the Ball Clan arose and led forth Bill Johnson, a Cayuga Warrior in his forties. She stood on the speaker's left, her candidate at her left; a man who was to be his deputy, and a third youth, who was being installed as a longhouse official, manifested subordinate rank to the first by standing in echelon formation to the rear at his right. To these Desga'he' pointed with his cane and announced that the first was being installed as Gadji'nonda'wehe', in the Ball Clan, and that as such the latter and the previous candidate, Haga'en'yonk, were as "sons to each other," a relationship that is difficult to explain but that the Iroquois accept with equanimity. Each Cayuga chief has one matron and two assistants: a guardian or deputy who is the chief warrior and an official for ceremonial occasions. These things having been explained, and the status of the others in relationship to the federal chief having been defined, the matron and the third male candidate for longhouse office retired, leaving the two leading Cayuga chiefs, Gibson and Johnson, and a lone deputy, facing the Three Brothers' side.

With respect to the first office to which

Hardy Gibson had been raised, the Onondagas, to wit, Joseph Logan and Peter Buck, asked for the details attending elevation of his predecessor, the late Chief Abram Charles. The Onondagas wanted to know how the previous candidate was qualified. Their speaker mentioned that this office had originally belonged to the Deer Clan. How was it that the Bear Clan now had it? The Four Brothers acknowledged this as a fact but stated that the present candidate was being installed on the same basis as his predecessor. The Deer Clan then had no suitable candidate, the title had virtually been transferred to the Bear Clan, and meanwhile the ashes of the Deer Clan had become cold. This would mean that the family line had died out.

The Onondagas next asked the candidate whether he had ever voted in an election for the elective council, which superseded the confederate council of life chiefs when the Indian Act went into effect about 1928. To this question Hardy Gibson replied that he was always a follower of the old system of chiefs, that they might recall that he had served as a deputy to his late uncle in the old council, and that he intended to keep up the old system for the benefit of generations to come. He was finally asked to speak. He acquitted himself well, amazing many that he commanded so well the ancient forms relating to the League.

In the examination of the second candidate it came out that this title also had belonged to the Deer Clan. But Mrs. Charles Bomberry is Dowen'he'gaa' (Ball Clan) and, having no eligible candidate in her family line, she was conferring the honor on Bill Johnson, a member of the same clan, according to my notes, but it was my impression at the ceremony that he had been selected from another line. If, however, both leading Cayuga chiefships were originally in the Deer Clan, or even in the same clan, we may have a clew to why they are called "the two sons" and why each calls the other "son."

Again the candidate was questioned as to whether he had ever voted for the elective chiefs. Some persons in the crowd thought this unnecessary because the candidate had always been identified with the Onondaga Longhouse, where he is known as a great worker, but others around me, members of the Mohawk Workers Party, considered the answer quite important. But the candidate demonstrated that he will probably make a good chief; he sidestepped the issue by saying that the only way is the old way. The Onondagas were satisfied. The Mohawk workers were not, but since they were not chiefs it did not matter. The Three Brothers were satisfied.

CHARGE TO THE NEW CHIEFS

It was now 8:40. Having seen the string and all taken hold of it, the speaker for the Three Brothers then stood to say: "Now it is indeed fulfilled: we have looked over the new one on whom you have placed the antlers of office and also his guardian the lady who owns the title; we accept both of them as we are notified by your word. Therefore the Three Brothers have now sanctioned (accepted) the two new candidates whom you have elevated. Now then get ready to hear something, you two candidates on whom they have just placed the antlers of chiefship." Whereupon the speaker sat down.

It was Chief Logan, Tadoda'ho himself, the leading chief of the confederacy who arose to make the charge. This was a great moment because Chief Logan not only holds an important office but he is a forthright person of great integrity. The public knew that the chiefs had entrusted this responsibility to him knowing he would fulfill it as the occasion demanded. Carrying a heavy bent wood cane of a type stock men employ in grading animals, Chief Logan crossed to the Four Brothers' side and confronted the two newly installed chiefs (Fig. 1). Speakers vary in how they discharge this role. According to my informants Chief Logan said:

> It is an amazing thing that what the Founders of the League established many years ago is still going on at the present time. The Founders of the League believed that a child was born of virgin birth and so he remained to do away with the blood-feud and other causes of unhappiness among the people in the early days. And that system has worked right up to the present day. Now you two are the leading Cayuga chiefs; Daga'enyonk and Gadji'nonda'weheh. As such you are

as sons to each other. Each shall call the other "my son." You two are the firekeepers of the Cayuga Nation. It is your duty to preside together at the councils of your tribe. But although you two are the leading Cayuga chiefs, you are no higher than the rest. All chiefs are of the same height.

Having addressed these and other remarks to the chiefs and the public, Logan emphasized the following virtues of chiefship menacing each of the new chiefs with his cane, as if everything depended on them:

You should do all in your power to protect and benefit the people and their children as well as the generations to come. Everything depends on you. The welfare of the people depends on how you deport yourselves. Remember always that the chief's skin is of seven spans in thickness (wa'sagondaden'sta' djowenhgaa'da') (the span of the thumb to middle finger, measured as an inch worm jumps). You will hear a lot of people talking, criticizing. Seven spans of skin will protect you. You will live clean lives so that the people will have great respect for you. You both know the evil spirit and the good spirit.

I am in a hurry now (turning away). There are many more things that I should say, but I am now at the point where I need food. (The speaker always makes a joke of this sort to prompt the cooks; sometimes he says the young girls want to dance.) But I trust that you will do the right thing.

Chief Logan had already returned to his place when he remembered an addendum. "I almost forgot," he said, "that you should know when the chiefs hold their councils. They meet on the first Tuesday of the month at the Onondaga Longhouse. It is your duty to attend."

At the end, after the Three Brothers had accepted them and charged them with their responsibilities, Hagya'trone' and Desga'he' solemnly took the two new chiefs by the arm and seated them among their colleagues.

The above account, observation coupled to remarks of informants, compares unfavorably with a typical text for the same (John A. Gibson to A. A. Goldenweiser, 1912):

CHARGE TO THE NEWLY INSTALLED CHIEF AND HIS GUARDIAN

They have thickened your skin so that it is now seven spans of the measuring bug, which henceforth shall be the thickness of your skin. And this means too that your mind shall be firm, not letting anything penetrate it (gossip especially), for possibly something pointed might stick into your skin when you come to take up your work for the cause of Righteousness, Peace, Justice, Law, and the League. For, indeed, you have now become the protector of the families of your nation.

And this is what he will say, "You shall be good natured, and what is more you shall love the people. And don't distinguish between any man, whether he be wealthy or poor, good natured or evil natured, or even very wicked; all of them you shall love equally not excepting anyone. And furthermore, in your consideration don't ever permit yourself to be selfish, thinking only of your self, but always remember the elderly people, the children too, and even those who are yet unborn under the ground have their faces coming this way. Always think of them in your deliberations so that everyone shall continue to be well disposed toward the successive generations of families. And then shall your grandchildren continue to prosper."

These are all of the words.

[And now turning to the matron and the deputy chief, whose responsibility it is to guard the chief.] Now, moreover, you shall obey that woman who is guarding your body as chief; and as for you yourself (addressing the matron) never let it happen that you spoil the word of your great one who is representing your maternal family.

Now, therefore, all of you chiefs shall be of one mind toward the newly installed one who will be your co-worker. You may now resume your combined duties toward the Great Law (League).

So these are the number of words. Now this ends the message of the Three Brothers.

With the seating of the new chiefs, we made a break for the door along with others who had sat through five hours of continuous ceremonial. Outside the moon had come up and it was crystal cold. Men returning from the brush were gathered in little knots to talk, others walked the circuit around the building that had been worn bare by generations of dancers cooling off. We paused to chat a moment with Tom Longboat, onetime Olympic marathoner, who had retired from Toronto to live in leisure among his Onondaga tribesmen. Tastefully attired in a dark overcoat of good make, a silk muffler in Paisley design, and a gray felt hat, Tom removed the pipe from his mouth, smiled, and remarked that he had enjoyed the ceremony, which he too was seeing for the first time. We went back inside to recover our seats. But that was a vain hope because others had taken them.

FEAST

We stood in the crowd by the west stove as pairs of cooks carried in steaming kettles slung on poles over their shoulders. Coming in at the far end of the building, they set a kettle down between the benches occupied by the Three Brothers' chiefs, and another for the Four Brothers. Others bore in trenchers and basket trays of chunk beef, which was distributed to the chiefs who eat first before the public. Deputies of the chiefs shared in this work, carrying the great baskets of sliced white bread from Jones's bakery in Caledonia, which they distributed among the crowd in a counter-clockwise direction. Nearly 150 pounds of beef, a hundred-odd loaves of bread, a sack of flour, 12 quarts of Indian white corn, and assorted groceries had gone into the cooking. The whole expense devolved on the family of the new chief and his kindred. (Actually the Viking Fund through the Smithsonian Institution and the Cranbrook Institute of Science had subsidized the feast.) But even so it was a small feast per person; Hardy Gibson told me that it used to be even more expensive to install a chief a generation ago. Then when less cash flowed into the Reserve, it nevertheless cost several hundred dollars. One had to buy a steer or two and the matron enlisted a number of women to make the corn bread. More labor went into the preparation and a larger crowd attended.

While the cooks were bringing in the kettles and during the hour from nine until ten that passed in feasting, several of the Three Brothers' chiefs were moved to speak. It is customary at this time for the hosts to inquire whether any of the chiefs have dreamed something, i.e., had an inspiration.

Meanwhile when outside we had missed the final address of the Four Brothers releasing the condoling chiefs at the end of the Charge to the new chiefs; the speaker for the Clear-minded Three Brothers had said, "Now that together we have finished the work and all is clear between us, you and I are free." And the Four Brothers replied:

Now then, my father's kinsmen, together you and I have finished everything. Therefore you shall be informed that the Four Brothers have prepared a feast. Accordingly the time being shall be devoted to this. And so let us eat together for a while. As soon as our meal is finished then the time shall be devoted to rejoicing together because the new one has been elevated that he may strive for the welfare of ongoing generations of our families. Now then we all shall rub antlers (name of the social dance of chiefs), you chiefs. Now, moreover, it is up to the crowd to have a good time.

So now, my father's clansmen, I now let escape from my hands our womenfolk. Accordingly you shall use them properly. Don't anyone treat them too roughly! (This remark always elicits much laughter.)

So now another thing. Time may also be devoted to something else. Perhaps one of you may have had a dream (some news to relate). Then in that event let us amuse our minds with dreams.

Meanwhile they eat the feast. Usually before anyone has an inspiration among the Three Brothers, one of them will reply, "No, we have no dreams to relate. We are young people yet and do not sleep much." (The implication is that they are out all night and have no time to dream.) But sometimes one may reply, "We have only one man here who sleeps much, and he has an inspiration." Then the speaker tells what he has dreamt, which is sometimes a pretense.

On the present occasion, Jim Martin (Tekariho'kenh), the leading Mohawk Chief, was speaking when we returned to the long-house. Not being at home in Mohawk and rather weary of Iroquois anyway, I was not listening, except in a general way, to what seemed to be a tirade directed at the Indian Act and the Indian Department in Ottawa. Chief Martin interspersed his Mohawk with enough English to let me think that I need not pay attention, when I was brought up short with, "Ne' Washington, Ne' London, Ne' Moscow——Ne' Atomic Bomb!" The Condolence Council of the Iroquois in the Atomic Age!

One other speaker addressed his remarks to a felt need for returning to the ways of the ancestors. He hoped that in the contemplated revision of the Indian Act that a way would be open for a return to government by life chiefs.

RUBBING ANTLERS

Chief of the Three Brothers' side conducted the social dance that followed the

feast. Roy Buck and another acted as floor managers, picking out the singers and dance leaders.

Leading off with the Trotting or Standing Quiver Dance, Onondaga Chiefs Peter Buck and Joe Logan turned out all the chiefs from both sides. They chugged around in fine humor, Pete Buck leading and Joe Logan supporting him, and the column of chiefs rubbing antlers was soon lengthened by a throng of dancers until the circle lapped itself three times. One wondered that these old men could keep up the pace.

Tcin'ha', or Garter Dance, came next. Roy Buck and Billy Buck, a famous singer, were the leaders. They soon had a throng following them. By this time the house was filled with dust and smoke and the heat of dancing. Outside couples were walking around the building cooling off. John Buck III, who lays cable for the telephone company in Hamilton, approached me because he understood that I had succeeded John Hewitt who had employed his father as informant. While we were talking, Jake Styres joined us, also the son of a chief who had served Hewitt. Jake might have been Deputy Chief to the newly installed Haga'-en'yonk, but he had demurred when the matron approached him. Employed for years as a miller in Caledonia, he has been too long among the white people, and matters relating to chiefship, he said, were too deep for him. Successful though they may be, the younger Iroquois decline to accept such responsibility lightly. He, too, was seeing his first Condolence.

We returned inside for the Fish Dance. It was now after 11 o'clock. The crowd danced until after 12, we were told, but we went out to our cars that were now covered with frost and drove home to Ohsweken to put down our heads for the night.

ZOOLOGY.—*Rhizocephala from New England and the Grand Banks.*[1] EDWARD G. REINHARD, Catholic University of America.

This paper, although dealing with only three species, includes all but one of the Rhizocephala at present known from the North American coast between Cape Cod on the south and Newfoundland on the north. The three discussed here are parasites of hermit crabs. The other species known to occur within this region is *Sylon hippolytes* M. Sars, which Hoek (1888) reported under the name *S. challengeri* as a parasite of the shrimp *Spirontocaris spinus* collected by the *Challenger* Expedition off Halifax, Nova Scotia.

The Rhizocephala from Greenland and Canadian waters, together with others from the eastern North Atlantic, have been treated in an extensive paper by Boschma (1928). Two of the species we include here were covered by Boschma from the standpoint of anatomy, taxonomy, and distribution, viz. *Peltogaster paguri* Rathke and *Clistosaccus paguri* Lilljeborg. Discussion of these will therefore be limited to new information on geographical distribution and notes on the larval stages of the first mentioned. The remaining species is new and its description is published herewith.

The collections of the United States National Museum, through the kindness of Dr. Waldo L. Schmitt, have been used in the preparation of this article. It also contains hitherto unpublished results of field work done by the author at Woods Hole, Mass., and Lamoine, Maine.

Family PELTOGASTERIDAE Lilljeborg
Genus **Peltogaster** Rathke
Peltogaster paguri Rathke

Fig. 1

Material examined.—All the specimens enumerated in the following list were found on *Pagurus pubescens* Krøyer:

Off Newfoundland, 45° 44′ 00″ N., 49° 45′ 00″ W., 35 fathoms, June 25, 1885; three specimens on three hosts, *Albatross* coll. U.S.N.M. no. 80456. (Sectioned one.)

Off Nova Scotia, 44° 28′ 00″ N., 60° 15′ 15″ W., 36 fathoms, July 7, 1885, eight specimens

[1] Received December 18, 1945.

on eight hosts, *Albatross* coll. U.S.N.M. no. 80453. (Sectioned one.)

Off Nova Scotia, 43° 37′ 00″ N., 49° 56′ 30″ W., 36 fathoms, June 24, 1885, two specimens on two hosts, *Albatross* coll. U.S.N.M. 80455.

Frenchmans Bay, Maine, littoral zone, July and August, 1938–1941, 455 specimens on 424 hosts, E. G. Reinhard coll. (Sectioned many.)

Casco Bay, Maine, 1873, one specimen on one host, U. S. Fish Comm. coll. U.S.N.M. 80458. (Examined by clearing.)

Off Cape Cod, Mass., 42° 01′ 00″ N., 68° 00′ 30″ W., 86 fathoms, August 30, 1883, one specimen on one host, *Albatross* coll. U.S.N.M. no. 80457. (Examined by clearing.)

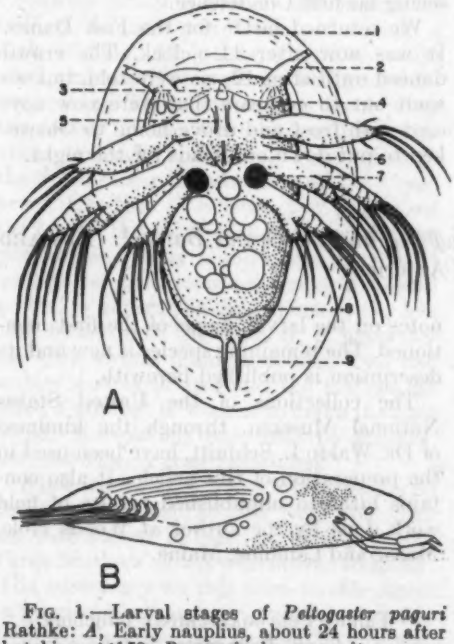


FIG. 1.—Larval stages of *Peltogaster paguri* Rathke: *A*, Early nauplius, about 24 hours after hatching, ×150; *B*, cypris larva as it appears when serving as a complemental male, ×150. (1, dorsal shield; 2, frontal horns; 3, unpigmented eye; 4, frontal glands; 5, frontal filaments; 6, labrum; 7, pigmented vesicle; 8, inner margin of dorsal shield; 9, caudal spines.)

Peltogaster paguri was first recorded for North America by A. S. Packard, Jr. (1866), who found a single specimen at Eastport, Maine. Boschma (1928) questioned the validity of this record and more so that of S. I. Smith (1884) who mentions this rhizocephalid on *Pagurus pubescens* off Laborador. His contention was that these two localities lie too far north for this species and that in all probability the parasite in question was *Clistosaccus paguri*.

It is now possible to state on the basis of the distribution records given in the present paper that Packard's identification was doubtless correct. The occurrence of *Peltogaster paguri* on the coast of Labrador, however, must still be held suspect.

Larval stages.—Nilsson-Cantell (1921) described and figured the first stage nauplius larva of *Peltogaster paguri*. In essential details his figure is a good representation of the nauplius before it is quite ready for expulsion from the mantle cavity. The shape then is somewhat triangular, and the frontal horns are directed outward and slightly backward. The size at this time is about 0.21 mm.

The nauplius described here (Fig. 1, A) is the free-swimming larva some 24 hours after it has been normally expelled from the mantle cavity. In this stage it is longer, about 0.28 mm excluding the shield, and somewhat egg-shaped in dorsal view. The frontal horns are now tilted forward and the anterior margin of the animal, while still convex, is slightly incised in front of the eye.

A prominent dorsal shield, extending beyond the tips of the frontal horns and the caudal spines, encloses the frontal, lateral, and caudal margins of the animal. It is a transparent, girdle-like covering, marked with ribs that form small diamond-shaped patterns.

The larva itself is colorless, as are the numerous fat droplets that it contains, but it possesses two pigmented vesicles, golden-orange in color, located at the level of the third pair of appendages, which are very distinctive in the living animal. The eye is unpigmented.

In side view the dorsal surface of the nauplius is convex, the ventral surface somewhat flattened except for an indentation at the anterior margin of the abdomen. The first and third pairs of appendages are about equal in length, while the second pair is slightly longer. All bear long hairs at the distal extremities. The number and position of these hairs are shown in the drawing. The spines at the tip of the abdomen are fairly long and slender. Mouth, alimentary tract, and anus are absent. Labrum and frontal filaments are present as in other rhizocephalan nauplii.

It is difficult to understand why Nilsson-Cantell remarks that in the larva of *Pelto-*

gaster paguri "ein deutlich abgesetztes Rückenschild fehlt." The dorsal shield is present in the majority of nauplii that are normally released from the egg membranes, but since it is not very securely fastened to the animal it may often be lost. It is possible, however, that the nauplii that Nilsson-Cantell studied were too immature to possess a distinct dorsal shield.

The cypris male (Fig. 1, B) is a slender larva entirely enclosed in a bivalve shell except for the antennae which project considerably beyond its anterior edge. The dimensions of the shell average 0.37 mm in length, 0.08 mm in height, and 0.03 mm in thickness. Its surface is smooth and colorless. The living animal within the shell shows spheres of orange color, which are scattered fat globules of various sizes.

The prominent antennae resemble a pair of grasping legs. Each is composed of four segments attached to a forklike tendon at the base. The first two segments are cylindrical, the third is broadened somewhat, and the fourth forms a sharp spine for piercing. These organs are inserted at a distance of about half their length from the extreme forward tip of the shell and emerge through the ventral gap between the valves. A small eye spot is located in front of the antennal tendons. The only other visible appendages are the short swimming legs. These consist of a basal segment and two small rami, each ramus being 2-segmented and terminating in several long stiff hairs that project through the posterior gap of the shell to form a conspicuous caudal tuft.

Clusters of these cypris larvae have been found on a number of occasions within the incipient mantle openings of the very young external sacs of *Peltogaster*, and a previous paper has dealt with their function in the reproductive cycle of this species (Reinhard, 1942a).

Peltogaster naushonensis, n. sp.

Fig. 2

The host of this rhizocephalid is a small hermit crab *Pagurus annulipes* (Stimpson), which is abundant and of general distribution throughout Vineyard Sound and Buzzards Bay on every sort of bottom from 2 to 17 fathoms (Sumner, Osburn, and Cole, 1913). It is rather surprising that this parasite has escaped observation until now, and credit is due Martin D. Burkenroad for calling the author's attention to it. Mr. Burkenroad brought in a live specimen at Woods Hole, Mass., on August 25, 1943. A few days later the author examined 35 hosts from the same locality and obtained one additional specimen. During the following summer Dr. John A. O'Brien, Jr., secured two more examples of this parasite through examination of 36 *P. annulipes*, also at Woods Hole. The infestation rate therefore appears to be about 4 to 5 percent.

Sections were made of the first two specimens obtained. One set of sections, designated as the type, has been deposited in the collections of the U. S. National Museum.

Types.—Holotype, U.S.N.M. no. 80916 (five slides), Tarpaulin Cove, Naushon Island, Vineyard Sound, Mass., 8 fathoms, on *Pagurus annulipes* (Stimpson), collected August 25, 1943, by M. D. Burkenroad; paratype, U.S.N.M. no. 80917 (whole specimen), Woods Hole, Mass., collected August 1944 by J. A. O'Brien, Jr.

Diagnosis.—Sacs solitary, length about two and one-half times breadth; stalk at center af dorsal surface with small shield; mantle opening at anterior end. Colleteric glands simple, accompanied by ganglion near their midregion. Testes short and saccular, at region of stalk, with long straight vasa deferentia. Retinacula absent.

Description.—The living animal is pale pink in color and its roots light green. The external sac is small, in conformity with the size of the host, and measures in the type specimen 4 mm in length and about 1.5 mm in width and thickness. The other specimens were of the following dimensions: 3.2 mm by 1.2 mm; 3.0 mm by 1.2 mm; 2.8 mm by 1.1 mm.

The mantle opening has the form of an elliptical slit guarded by an elevated sphincter. The stalk is located at the center of the dorsal surface and arises from a thin slipper-shaped chitinous shield. In its general external features the animal resembles a small *Peltogaster paguri* except that it is already mature at a size when the latter species would be less than half-grown. All four specimens had the mantle cavity filled with eggs.

The mantle is rather thin and measures 13μ to 18μ in thickness over much of its extent, although occasional areas may measure as much as 45μ. In the type specimen the visceral mass is distended with strings of eggs and has an obovate form in cross section. In the other

specimen sectioned the form of the visceral mass is much narrower since ovarian eggs are relatively few.

In studying the serial sections in order, the colleteric glands appear first. These begin immediately in front of the shield and continue to the level of the middle of the stalk. They are dorsolateral in position and have a simple or forked lumen. Just before reaching the stalk the sections begin to show the ganglion, whose main mass coincides with the anterior edge of the stalk. The ganglion has the appearance of a squat triangle, its apex extending ventrally between the colleteric glands and its base directed toward the shield.

The left testis begins immediately behind the ganglion and appears in the same sections which contain the posterior portions of the colleteric glands. The right testis begins somewhat farther back, posterior to the colleteric glands. Both are short bag-shaped organs whose entire extent is confined to the limits of the stalk. Each measures about 130μ in length. The testes are enveloped by a heavy connective tissue theca of wavy fibers but do not possess a basement membrane.

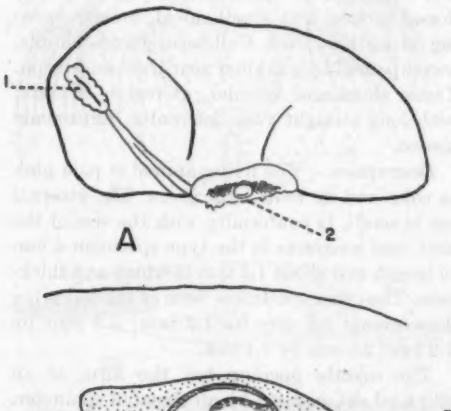


FIG. 2.—*Peltogaster naushonensis*, n. sp.: *A*, Ventrolateral view of type specimen from *Pagurus annulipes* (Stimpson), Woods Hole, Mass., ×15; *B*, portion of cleared specimen, region of stalk, showing position and shape of testes, ×70. (1, mantle opening; 2, attachment to host; 3, right testis; 4, stalk; 5, chitinous shield.)

The vasa deferentia are about twice as long as the testes. They emerge abruptly and extend as straight tubes a distance of about 264μ to emerge on the lateral surface of the visceral mass near the posterior limit of dorsal shield.

In the shape of the testes, the position of the ganglion, the uncoiled vasa deferentia, and the absence of retinacula this species is sharply distinguished from *Peltogaster paguri* Rathke.

Family CLISTOSACCIDAE Boschma
Genus **Clistosaccus** Lilljeborg
Clistosaccus paguri Lilljeborg

Material examined.—Off Newfoundland, 45° 44′ 00″ N., 49° 45′ 00″ W., 35 fathoms, June 25, 1885; one specimen on *Pagurus pubescens* Kröyer, *Albatross* coll. (Sectioned.)

Off Nova Scotia, 44° 28′ 00″ N., 60° 15′ 15′ W., 36 fathoms, July 7, 1885; four specimens on one *Pagurus pubescens* Kröyer, *Albatross* coll. U.S.N.M. no. 80454. (Sectioned one.)

Clistosaccus paguri has previously been collected in the Atlantic waters of the Western Hemisphere only from the west coast of Greenland (Boschma, 1928). These records extend the known range of this species south to the Grand Banks, where it overlaps the northern limit of *Peltogaster paguri* Rathke. At both stations *Clistosaccus paguri* and *Peltogaster paguri* were present on the same species of host crab.

The specimen collected off Newfoundland measured 20 mm in length. It was sectioned and gave evidence of being a senescent individual with degenerating visceral mass and greatly atrophied testis and colleteric glands. The four parasites on the other crab varied from 11 to 13 mm in length. This host, a female of 20 mm carapace length, also bore two scars where former parasites had been attached. One of the larger clistosaccids was sectioned and the internal anatomy was found to be characteristic of this species.

The first-mentioned specimen and three of the four others were unusual in having the mantle opening directed backward. Such a reversed orientation often occurs in cases of multiple parasitism (Reinhard, 1942b). The C-shaped mantle opening and broad stalk of attachment, important external diagnostic

features pointed out in the case of specimens from the Northwest Pacific (Reinhard, 1944), were likewise present in these specimens from the North Atlantic.

LITERATURE CITED

BOSCHMA, H. *Rhizocephala of the North Atlantic.* Danish Ingolf Expedition 3 (10): 1–49. 1928.

HOEK, P. P. C. *Description of* Sylon challengeri, *n. sp., a parasitic cirriped.* Appendix A in: Report on the Crustacea Macrura collected by H.M.S. *Challenger* during the years 1873–76, by C. Spence Bate. Zool. *Challenger* Exped. part 52: 919–926. 1888.

NILSSON-CANTELL, C. A. *Cirripeden-Studien. Zur Kenntniss der Biologie, Anatomie und Systematik dieser Gruppe.* Zool. Bidrag Uppsala 7: 75–378. 1921.

PACKARD, A. S., Jr. *Observations on the glacial phenomena of Labrador and Maine, with a view of the recent invertebrate fauna of Labrador.* Mem. Boston Soc. Nat. Hist. 1: 210–303. 1866.

REINHARD, E. G. *The reproductive rôle of the complemental males of Peltogaster.* Journ. Morph. 70: 389–402. 1942a.

———. *Studies on the life history and host-parasite relationship of* Peltogaster paguri. Biol. Bull. 83: 401–415. 1942b.

———. *Rhizocephalan parasites of hermit crabs from the Northwest Pacific.* Journ. Washington Acad. Sci. 34: 49–58. 1944.

SMITH, S. I. *Review of the marine Crustacea of Labrador.* Proc. U. S. Nat. Mus. 6: 223–232. 1884.

SUMNER, F. B., OSBURN, R. C., and COLE, L. J. *A biological survey of the waters of Woods Hole and vicinity.* Bull. Bur. Fisheries 31 (2): 549–860. 1913.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

GEOLOGICAL SOCIETY

625TH MEETING

The 625th meeting of the Society was held at the Cosmos Club, January 10, 1945, President L. W. CURRIER presiding.

Informal communication.—C. MILTON discussed caliche-top-coated cobbles from a glacial moraine in northwestern New Jersey.

Program.—C. L. GORDON: *Attack of minerals by acids at elevated temperatures.* Refractory metals and alloys of the platinum group, such as the native grain platinum minerals, can be easily prepared for analysis by solution with hydrochloric acid and suitable oxidants in sealed tubes at temperatures up to 300° C. The method is less laborious than preparing solutions by fusion methods and has another advantage in that the solution obtained does not contain undesirable amounts of alkali salts. The solution of many refractory oxides and silicate minerals is successfully attained by the simple method of sealing the mineral with hydrochloric acid in a Pyrex glass tube and heating. On the microscale this method requires no other precaution than that the heating be conducted in a uniform manner.

Details of the sealed tube technics are published as Research Papers 1614, 1621 and 1622 in the Journal of Research of the National Bureau of Standards.

As a result of trials of the method of silicate minerals it was found that decomposition of the albite-anorthite series of plagioclase feldspars was not uniformly graded from complete for anorthite to none for albite. There is an abrupt change at $Ab_{40}An_{60}$ corresponding to about 58 percent silica, above which solution was not appreciable and below which solution was complete. This is thought to be the first clearly defined evidence for "resistance limits" (as shown by Tammann for several series of alloys and for a series of synthetic mixed crystals) in an isomorphous natural mineral replacement series.

K. J. MURATA and W. G. SCHLECHT: *Chemical behavior and crystal structure of silicate minerals.* The two kinds of behavior, gelatinization and separation of insoluble silica, shown by silicate minerals when decomposed by acids, have been correlated with the internal structure and composition of the minerals (Amer. Min. 28: 545–562. 1943). A further study of 44 minerals with continuous, 3-dimensional silicon-oxygen and aluminum-oxygen structures, such as feldspars and zeolites, has been made, and the way in which the aluminum-silicon ratio determines their behavior is emphasized. Such minerals with an aluminum to silicon ratio smaller than 1:2 will separate insoluble silica, while those richer in aluminum will gelatinize.

On the assumption that the acid treatment dissolves away aluminum from the alumino-silicate structures and leaves behind silicon-oxygen clusters, the gelatinization behavior is thought to depend on the sizes of these clus-

ters. If they are small enough to dissolve in the acid, they will form a gel; otherwise they will separate as insoluble residual silica. X-rays do not show the arrangement of the silicon and aluminum atoms with respect to each other in the crystal structure; but the behavior of the minerals toward acids shows that in the gelatinizing minerals the arrangement must be such that small clusters of silica are released when the aluminum is dissolved away. A theoretical study shows that such a arrangement cannot be random, but must have as regular a pattern as possible, in the ranges of composition that occur. Calculation of the distribution of cluster-sizes shows that in a random arrangement there would not be enough of the smaller clusters to form a gel.

The limiting aluminum-silicon ratio of 1 to 2 for gelatinization in 3-dimensional silicate structures is the same as the resistance limit to attack found by Gordon and Wichers (see preceding abstract) for plagioclase feldspars heated with acid in sealed tubes. This ratio may be considered a resistance limit for an aluminum-silicon solid solution series, with a three-dimensional structure—a limit arrived at indirectly, by using different individual minerals to represent the various aluminum-silicon ratios. As predicted by Tammann, the structure can have a sharp resistance limit to attack only if the two kinds of atoms are symmetrically distributed in the structure.

This study is described in Contributions to Geochemistry, 1942–45, U. S. Geol. Surv. Bull. 950 (in press).

A. J. BODENLOS: *Structural control of the magnesite vein system in the Red Mountain district, Calif.* The Red Mountain district is on the border of Santa Clara and Stanislaus Counties, Calif., 31 miles southeast of Livermore. The magnesite deposits are in an ultrabasic intrusive body consisting chiefly of peridotite and dunite. There are five deposits in the area, the two largest being operated by the Western Mine. The magnesite is a vein mineral, deposited in premagnesite serpentinized shear and crush zones. Throughout mineralization the sites of mineral deposition have been closely controlled by structural features, as shown by: limitation of the large deposits to serpentinized shear and crush zones; localization of ore bodies within the shear and crush zones; and localization of high-grade shoots within ore bodies. The length and width of ore bodies are most variable, but the vertical extent is limited, rarely exceeding 400 feet in depth. Postmagnesite minerals, including chalcedony, opal, hydrated magnesium silicates, dolomite, and calcite, are deposited in the fractures produced by recurrent movement in the shear and crush zones. The magnesite is cryptocrystalline, white, and porcelanic in appearance, and was deposited mainly as nodular bodies replacing serpentine and also as fissure-filling in open fractures. Magnesite at Red Mountain is considered to have been deposited near the surface from low-temperature hypogene solutions.

626TH MEETING

The 626th meeting of the Society was held at the Cosmos Club, February 14, 1945, President L. W. CURRIER presiding.

Program.—G. H. ESPENSHADE: *Tungsten deposits in Vance County, N. C., and Mecklenburg County, Va.*

M. FLEISCHER, S. K. NEUSCHEL, and J. M. AXELROD: *Occurrence of tungsten and vanadium in manganese oxide minerals and ores.* The occurrence of tungsten in manganese oxide ores was first noted by Penrose in 1890 and since has been discussed by several authors. Vanadium has been reported in four analyses of manganese oxides. New analyses in the Chemical Laboratory of the Federal Geological Survey have shown that these elements occur commonly in manganese oxide ores, especially in those from the southwestern United States. Over 50 new occurrences have been noted, and many more will doubtless be found by systematic chemical testing.

In some deposits the tungsten and vanadium content of the ore varies directly with the manganese content, indicating that the tungsten and vanadium are in the manganese-oxide mineral. This is not true of a few deposits, including that at Golconda, Nev. X-ray study and chemical analysis show that tungsten and vanadium occur most frequently in manganese oxides that contain barium. Over three-fourths of the tungsten-bearing samples studied are the barium manganate psilomelane. Over two-thirds of the vanadium-bearing samples studied are either psilomelane or hollandite.

No generalization can yet be made as to the origin of the tungsten-bearing and vanadium-bearing manganese oxide ores. Many are of hydrothermal origin, but some appear to be secondary.

T. G. PAYNE: *Stratigraphic and structural features, lower Matanuska Valley coal field, Alaska.* High-volatile bituminous coal is produced from a Tertiary sequence. The sequence, about 6,000 feet thick, is subdivided into four parts, in ascending order: (1) 2,500 feet of alternating beds of sandstone, finer clastics, and some coal, mostly nonminable, (2) 600 feet of conglomerate, in two facies derived from different source areas, interbedded with arkosic sandstone, (3) 1,200 feet of coal measures, and (4) 1,700 feet of conglomerate and sandstone. These parts indicate alternating periods of weak and strong orogenic movements. Second-order cycles in the coal measures began with dominance of river sedimentation forming sandstone, containing channel conglomerates locally at the base, grading upward into flood-plain silts and silty clays containing a few widely spaced coal beds. After this, relative quiescence led to long-sustained regional swamp and stagnant-lake conditions forming alternating beds of minable coal, bone, claystone, and intermediate types. Relative uplift of the source area, with increased stream gradients, started a repetition of the cycle.

Stratigraphic intervals change in thickness laterally, as a result of differential compaction of sediments having marked lateral textural differences. Amount of compaction is evaluated to determine original sedimentational thickness used in correlation.

Mines are at both ends and along the north limb of a canoe-shaped syncline cut by two sets of transverse faults of horizontal displacement. An underthrust strike fault coincides with an area of tight subsidiary folding on part of the north limb.

627TH MEETING

The 627th meeting of the Society was held of the Cosmos Club, February 28, 1945, President L. W. CURRIER presiding.

Informal communication.—L. HENBEST reported on blasted limestone near Jemez Springs, N. Mex.

Program.—J. F. MCALLISTER: *Geology of quicksilver deposits in Chile.*

G. C. HARDIN, Jr.: *Fluorspar deposits of the Babb fault system, Ky.*

D. E. WHITE: *Localization of the antimony deposits of Mexico.* Most of the world's antimony deposits seem closely related to the circum-Pacific belts of Tertiary and Quaternary vulcanism and diastrophism. Nearly all the Mexican production, which is about 20 percent of the world total, is from a belt 1,400 miles long by 10 to 100 miles wide, in the pre-Tertiary rocks adjacent to the northeastern border and ends of Mexico's large area of Tertiary lavas. The antimony deposits are probably related to the Tertiary volcanic activity, though possibly less closely than most of the tin and quicksilver deposits.

The antimony deposits are largely in limestone, but some are in other types of rocks. The deposits in limestone are accompanied by silicification and locally by replacement by clay minerals; solution cavities are common. The original ore mineral was stibnite, that is generally oxidized; deposits in limestone commonly carry small amounts of mercury.

The dominant structural controls are faults, fractures, and anticlinal axes; chemical control may be important. In the three most productive districts, the ore is near contacts of limestone with overlying shale, adjacent to the feeding channels. In contrast, in most other districts in limestone, the shale is lacking. Six major districts are described; in one the ore is probably related genetically to the source of the associated quartz prophyry.

Mining has not gone below a depth of 600 feet, because of the relatively low value of the ore, and the horizontal control of the ore bodies by structure or lithology. The grade of the ore may also be related to the surface, but evidence is lacking. Wherever favorable structure exists, however, the deposits undoubtedly extend below the depths of present mining.

628TH MEETING

The 628th meeting of the Society was held at the Cosmos Club, March 14, 1945, President L. W. CURRIER presiding.

Program.—H. T. U. SMITH: *Rock streams in the Blue Ridge.* Bare, streamlike accumulations of boulders along valley bottoms occur at widely separated localities along the Blue Ridge from southern Pennsylvania to West Virginia. The boulders are loosely packed, unsorted, heterogeneous in size and shape, and range up to about 12 feet in length. The sound of running water beneath the surface is audible. The accumulations are up to 1,800 feet in length and 100 feet in width. Surface gradient is generally 3° to 5°. The boulders are of quartzite derived from neighboring slopes and

ridges. They are now lichen-covered, are undergoing disintegration in place, and show no evidence of appreciable present-day movement. The rock streams appear to be "fossil" forms, and are best explained as a product of widespread movement of frost-riven blocks down valley slopes by solifluction under periglacial conditions of Pleistocene time, with subsequent localized removal of interstitial material by running water. This explanation applies also to the boulder-choked valleys and subdued, overgrown talus slopes which are more widespread in the area.

L. HENBEST: *Correlation of the marine Pennsylvanian rocks of northern New Mexico and western Colorado.* The lower limestone member of the Sandia formation, in the southern Sangre de Cristo Range, seemingly unfossiliferous and formerly classed as Pennsylvanian, proves to contain *Endothyra baileyi* (Hall), a Mississippian foraminifer characteristic of the Leadville limestone. This member, also present locally in the Sandia Range, resembles the Leadville of the San Juan Mountains and extends the Mississippian 200 miles southward. Pennsylvanian deposition began with terrestrial clastics on a deeply weathered, uneven surface at many widely distributed localties. These clastics range in age from Springer to Morrow and correlate with the intensely red Molas formation. An extensive marine invasion of Morrow age is indicated by a wide distribution of the *Millerella* fauna. *Millerella* characterizes the Glen Eyrie shale member of the Fountain formation; part of the Belden shale member of the Battle Mountain formation of Brill at Glenwood Springs and Salida; basal Hermosa, subsurface in San Juan County, N. Mex.; and the lowest Pennsylvanian limestone beds in Moffat County, Colo., and in adjacent parts of Utah. *Fusulinella* faunas (Atoka age) characterize the basal 100 feet of the Hermosa formation, San Juan Mountains, and a prominently developed zone in northwestern Colorado and adjacent Utah. They are present in the Crested Butte area, San Juan County, N. Mex. (Hermosa formation), Sierra Nacimiento (Madera formation), Sandia Range (Sandia (?) formation), etc. *Fusulina-Wedekindellina* faunas (lower Des Moines age), characterize the most widely and prominently developed marine zone in this province. They occur in the Robinson limestone of Emmons, the upper McCoy formation of Roth, the middle and upper type Hermosa formation and in La Veta Pass and the southern Sangre de Cristo Range, Sandia Range, Manzano Range, Sierra Nacimiento, and northwestern Colorado and adjacent Utah. The *Fusulina girtyi* zone (middle Des Moines) is generally lacking. The apparently uppermost Des Moines species of *Fusulina* are found so far only in the Sierra Nacimiento and in Juniper and Cross Mountains in Moffat County, Colo. The zones of *Millerella*, *Fusulinella*, and *Fusulina-Wedekindellina* are well displayed in Juniper and Cross Mountains, but the rocks of equivalent age become more clastic and less fossiliferous westward. If rocks of Missouri or Virgil age are present in the western Colorado uplifts they are generally represented by redbeds and clastics barren of Fusulinidae.

G. W. STOSE: *A description of the geologic map of South America.* A hand-colored first draft of the geologic map of South America, compiled under the auspices of the Geological Society of America, the American Geographical Society, and the U. S. Geological Survey, to be published as a special paper of the Geological Society of America, was presented. It was pointed out that the Archean complex and overlying Algonkian sediments in the Brazilian shield are comparable to pre-Cambrian rocks of the Appalachians of the United States, that the Gondwana series of South America culminates in redbeds and vast basalt flows of late Triassic age comparable to the Newark series of the Appalachians, that late Carboniferous granites and Paleozoic rocks in eastern Colombia may be the southward extension of Appalachian structures in the United States, and that the late Cretaceous to early Tertiary granitic intrusions of the Sierras are continuous with those in the Andes from Colombia to Patagonia.

629TH MEETING

The 629th meeting of the Society was held at the Cosmos Club, March 28, 1945, President L. W. CURRIER presiding.

Program.—C. WAHRHAFTIG: *Preliminary report on the physiographic history of part of the Alaska Range.* The results of field studies in connection with the investigation of coal deposits in the Alaska Range and of studies of aerial photographs indicate that the late Ter-

tiary and Quaternary geology of the Alaska Range can be summarized as follows: First, uplift of mid-Tertiary mountains, faulting and folding the coal-bearing sediments, resulting in the deposition and later deformation of 5,000 feet of continental Nenana gravel. Second, reduction of at least part of these mountains to a nearly level surface. Third, warping of this surface along east-west axes. The Alaska Range was uplifted, and the Tanana flats to the north depressed. The history of this warping is evidenced by numerous superimposed streams and excellently preserved terraces and erosion surfaces. Glaciers advanced north from the Alaska Range on two occasions; the surface on which the early advance took place is at the level of the Nenana River at the northern border of the mountains, and is 2,300 feet above the river 20 miles to the south. The terminal moraine of the latest (Wisconsin) ice advance is preserved at Healy on a terrace 400 feet above the Nenana River. This terrace merges with the level of the river 20 miles north. What appears to have been a dome subsidiary to the main uplift of the Alaska Range has produced the Kantishna Hills. Doming of these hills has forced the drainage from the Alaska Range around the southwest end of the Kantishna Hills. Sediment formation in a manner similar to that prevailing in arid regions appears to have contributed to the development of the various terraces and surfaces as much as lateral planation of the major streams.

C. P. Ross and J. D. FORRESTER: *The new geologic map of Idaho.* The recently compiled geologic map of Idaho is expected to be ready to go to the printer in April 1945. Although a number of small-scale geologic maps of the state have appeared, this is the first colored map in comparable detail that has yet been prepared for publication. It should be the forerunner of others.

The map shows the Idaho batholith, and other intrusive bodies, the wide expanses of Belt rocks, the highly deformed Paleozoic and Mesozoic strata, and the extensive and varied cover of Tertiary and later rocks. The famous Coeur d'Alene region, marked on the map by a complex of faults, continues to be the most productive mining area in the state but during World War II notable contributions in tungsten, quicksilver, antimony and other metals have been made by mines farther south. The Phosphoria formation, one of the map units conspicuous in the southeastern part of the state, has long been famous for its phosphate reserves and more recently for its vanadium.

The geologic map, accompanied by structure sections and a bibliographic index map, is to be published under a cooperative agreement between the U. S. Geological Survey and the Idaho Bureau of Mines and Geology.

G. A. COOPER: *Stratigraphy of the Caborca area, northwestern Sonora, Mexico.*

630TH MEETING

The 630th meeting of the Society was held at the Cosmos Club, April 11, 1945, Vice-president A. A. BAKER presiding.

Program.—P. B. KING: *Tectonic map of the United States.* A tectonic map of the United States was published in 1944 by the American Association of Petroleum Geologists. A tectonic map is one that depicts by symbols and patterns the geologic structure—that is, the lay of the rock strata, their folds and dislocations, and the position of volcanoes, salt domes, and many other features. The tectonic map of the United States is the result of long planning and cooperative endeavor by American geologists and their organizations. It was compiled by the Committee on Tectonics of the National Research Council. The map is based in part upon published sources, such as the numerous maps issued by the Federal Geological Survey. In addition, a large amount of unpublished material was furnished by petroleum geologists. On the map, the structure of the gently tilted rocks of the central interior region and the coastal plains is represented by contour lines. To a large extent these contours are derived from data obtained in the drilling of numerous wells put down in the search for oil and gas. The tectonic map is of considerable academic interest, but it is also being used by geologists who are searching for new productive provinces for petroleum and for ore deposits.

A. H. HOWLAND: *Petrology of the Society Islands.*

S. S. NYE: *Orogeny of the Mexican Plateau and its relation to ore, oil, and ground water.* The search for ground-water for the irrigation of guayule in the basins near Torreon[1] necessitated a consideration of the origin of the

[1] By an employee of the Emergency Rubber Project, U. S. Forest Service.

basins. The conclusion was reached that the excavation of the basins by stream erosion is impossible and that the basins are the product of two major periods of down-faulting and filling with detrital material. The following hypothesis was offered:

Beginning in late Cretaceous time a great body of magma was formed beneath the entire Mexican plateau through the constant addition of heat. Expansive forces resulting from the heating of the magma lifted the plateau. Fractures formed along the south and west sides permitted the extrusion of lavas. The subsequent loss of temperature and pressure within the magma chamber resulted in the structural failure of its roof and collapse of the basins. Deformation of the strata in the Eastern Sierra Madre and south of the Parras Basin resulted from sliding and falling of these strata on a pre-Jurassic surface. High temperature ore deposits occur in fractures formed during the lift of the plateau, moderate temperature deposits in fractures formed during the first collapse, and low temperature deposits in the fractures formed during the second collapse. Oil structures within the plateau were destroyed; mild deformation on the coastal plains permitted the later accumulation of oil. Fracturing during the uplift and basin faultings provided initial reservoir and channel openings for the large springs. The first basin fill, derived largely from shales, contains little, if any, high yielding water-bearing material. Water for large-scale irrigation should be sought for in the secondary basins where there are large amounts of unconsolidated gravel and sand.

631ST MEETING

The 631st meeting of the Society was held at the Cosmos Club, October 24, 1945, President L. W. CURRIER presiding.

Program.—MARIE L. LINDBERG: *Bromine in carnallite and sylvite.* Both carnallite and sylvite from Eddy County, N. Mex., contain 0.1 percent of bromine. The bromine content of these minerals from Grand County, Utah, is three times as great. No bromine was detected in halite, polyhalite, langbeinite, or anhydrite from New Mexico. Iodine was not detected in any of these minerals. On the basis of the bromine content of the sylvite from New Mexico, it is calculated that 7,000 tons of bromine were present in potash salts mined from the Permian Basin during the period 1931 to 1943.

H. T. U. SMITH: *Giant glacial furrows in northwest Canada.* In the Mackenzie Valley area west of Great Bear Lake, many ridges and mountain slopes are cut by glacial grooves on a scale far larger than previously recorded. Individual grooves range up to about 100 feet in depth and more than a mile in length. The grooves are essentially straight, parallel, and closely spaced, forming a characteristic ridge-and-trough topography. They occur in zones showing the influence of both topographic exposure and differential erodibility of the bedrock. The orientation of the grooves is indifferent to structural trends and to drainage lines. The alignment of grooves in the several zones falls into a systematic pattern recording the advance of a continental ice sheet northwest along the Mackenzie Valley.

J. B. MERTIE, JR.: *A review: "Atomic Energy for Military Purposes," by Henry D. Smyth.*

632D MEETING

The 632d meeting of the Society was held at the Cosmos Club, November 14, 1945, President L. W. CURRIER presiding.

Program.—C. B. HUNT: *Military geology.*

633D MEETING

The 633d meeting of the Society was held at the Cosmos Club, December 12, 1945, Secretary J. VAN N. DORR, 2d, presiding.

Program.—Presidential address by L. W. CURRIER: *"Granitization" as a regional metamorphic process in New England.*

53D ANNUAL MEETING

The 53d Annual meeting was held immediately following the 633d regular meeting. The reports of the meeting secretary, treasurer, and auditing committee were read and approved. Officers for the year 1946 were then elected:

President: W. H. BRADLEY
Vice-presidents: W. F. FOSHAG and J. C. REED
Secretary (2 years): MEDORA H. KRIEGER
Treasurer: M. K. CARRON
Members-at-large of the Council: ALICE ALLEN, J. R. BALSLEY, W. H. HASS, A. H. KOSCHMANN, and V. E. MCKELVEY.

The Society nominated L. W. CURRIER to be a vice-president of the Washington Academy of Sciences for the year 1946.